THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. MAY 25, 1899. CHICAGO, ILL. NUMBER 21

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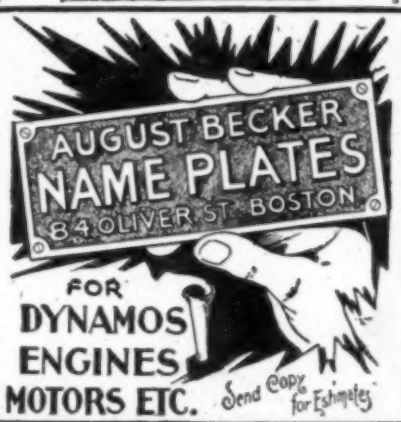

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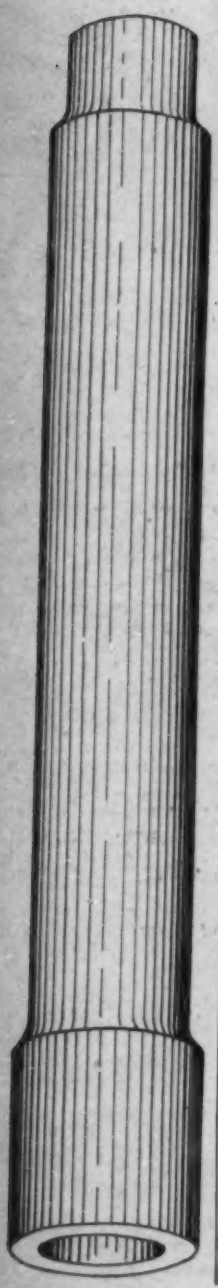

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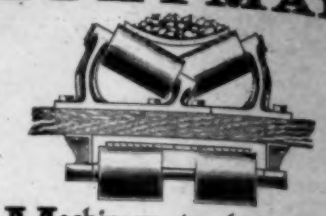

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. MAY 25, 1899. CHICAGO, ILL. NUMBER 21

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Prices are still advancing in iron and steel, but the buying movement does not slacken. This is especially true of pig iron, in which there have been some large deals, besides a good aggregate of lesser sales. Producers of Bessemer iron in the Mahoning and Shenango valleys have sold 51,000 tons at $16 to the leading Pittsburg steel maker, and it is now well known that the associated furnaces have much less iron to sell for delivery before Jan. 1 than will be needed by steel works in that time over and above their own production. A meeting of valley furnacemen in Cleveland at this writing is expected to make a price of $17 valley on a limited amount of iron. The Republic Iron & Steel Co. has made a beginning of purchases of mill iron for the second half of the year, 25,000 tons of Southern being taken. Large requirements are yet to be provided for, and furnacemen are questioning how the iron is to be provided. The cast iron pipe consolidation is also about to enter the market. Malleable interests have been making inquiry and several blocks of iron are under negotiation. Chicago district sales have been fully 75,000 tons the past week, and this will be materially increased in the next fortnight. In general from 50 cents to 75 cents a ton has been added to the price of foundry iron since the beginning of the month, and buyers who thought the prices of a month ago high and likely to recede under increased production, are now paying current quotations to provide their supply for the balance of the year. Southern No. 2 is now $12.50 Birmingham and gray forge $11.25. Foundrymen are advancing prices of castings, but the movement is very uneven, and in most lines does not correspond as yet to the advance in iron. However, the test will soon come, of the willingness of the ultimate consumer to pay prices based on the present high plane of values in iron and steel. Implement manufacturers, whose pig iron, steel and malleables are costing 50 to 80 per cent more than last year's prices, will shortly be able to gauge the capacity of the farming community to buy high-priced machinery. It does not appear that the consumer's attitude will be a determining factor in this year's account. In all departments of the iron market the uppermost consideration for the present year is that of getting the material needed. The billet situation is getting more acute, as is that in respect to pig iron. Sales at $28 Pittsburg, and even higher, in small lots, are reported. It is plain that converting capacity will be taxed to its utmost for the next six months. Some relief may come from the new open-hearth plant that will be available after midsummer. By another year open-hearth production at Sharon, Pa., and at Cleveland will be materially increased. The Republic Iron & Steel Co. has made sales of bar iron in the week on a basis of 1.65c in the Mahoning valley, carload lots, or 1.70c Cleveland. At Chicago considerable sales have been made at 1.70c and a heavy tonnage for railroad and implement needs will be closed in the next two weeks in view of present inquiries. Sheets have advanced $2 a ton to 2.90c Pittsburg for No. 27. The sheet mill consolidation seems well rounded up, and is now in the hands of Chicago interests for the arrangement of details. The last announcement concerning the Carnegie Steel Co. takes it out of the New Jersey category, in which all preliminary discussion of the project had placed it; and Mr. Frick's statement settles two important points: the charter will be under Pennsylvania laws and the capital will be $250,000,000, with but one kind of stock. Advices from Detroit are that the radical wing of the Amalgamated Association controlled in fixing some of the wage scales, particularly that on tin plate, and the prospect of a speedy agreement at Thursday's meeting with the manufacturers is not the best.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World*, 705 PUBLICATION BUILDING, May 24.

The iron and steel market continues to advance, with no signs of abatement in the upward movement. The market possesses every indication of immediate strength and considering the circumstances it must necessarily be a long time before any serious drop can occur. The ore supply is no more than sufficient to keep furnaces going that are now in blast, and the opportunity to increase production is therefore very small so far as Bessemer is concerned. Producers are generally almost entirely sold up to the end of the year. It is reported that the leading local interests can take on practically no more tonnage up to the end of the year, and yet it has been compelled to purchase from 50,000 to 100,000 tons of pig iron, the bulk of which came from the valleys, and it is not certain that even this will be sufficient to take care of converting capacity. The situation is therefore a very strong one, and while some pretend to decry the strong upward movement, there are none who are making any effort to stop it. Some slight relief may be expected in the plate situation from the starting in operation, probably by the end of this week, of the two plate mills in the old Moorhead-McCleane plant, just purchased by Jones & Laughlin, Ltd. The output will be about 150 tons a day. The steel will come largely from the open-hearth furnaces in this plant and the Linden plant, purchased some time ago. The sheet consolidation is regarded as almost consummated, the details now being under advisement in Chicago.

The manufacturers of cold rolled shafting held a meeting at Bass Lake, O., last week, and advanced prices from 40 per

cent off list to 35 per cent off list, an advance for a quarter of a cent a pound or $5 a ton.

PIG IRON.—The entire membership of the valley furnacemen's association—considerably less than when the movement started last year, several furnaces having been absorbed by the consolidations—is represented at a meeting in Cleveland to-day, attended also by W. P. Snyder, who has been agent in Pittsburg for some time. The furnacemen's price of $16 was limited to 50,000 tons, and this has all been taken, the great bulk going to the Carnegie Steel Co., which is understood to be in the market for further quantities. Some odd sales have ben made at above $16 since the 50,000 tons were disposed of, one sale being made at $16.50 of a small lot of outside iron, while sales have been made of Pittsburg iron at $17.50, and in the valley a $17 price is now established, though not by any action as yet of furnacemen, and nothing better can be done in Pittsburg. In foundry iron there has been a great deal of activity, and prices have steadily advanced. Sales of No 2 are reported as high as $16.75, which does not, of course, represent the market. In gray forge there has been some activity, and the price is firm at not under $15, while sales have been made considerably above this figure. The market is excited and irregular and we quote as follows:

Bessemer, valley furnace	$17.00
Bessemer, Pittsburg	17.65
No. 1 Foundry	16.50 to $16.75
No. 2 Foundry	16.25 to 16.75
No. 3 Foundry	15.75 to 16.00
Gray Forge, valley furnace	14.75 to 15.00
Gray Forge, Pittsburg	15.00 to 15.25

STEEL.—The steel market is very active in small sales, there being very little available tonnage, and prices in consequence have advanced materially. Predictions are freely made that the market will pass $30 before the first day of July. We note sales at $28.50 and upwards, as high as $30, it is claimed, having been paid in one instance. The market is strong and irregular at $28.50 to $29 for Bessemer. There is practically no open-hearth to be had. In wire rods and sheet bars there have been no transactions.

FERRO-MANGANESE.—The ferro market is unchanged at $75 quoted for good sized lots.

RAILS AND TRACK MATERIAL.—The market for track material is very much stronger and prices are quoted decidedly on nearly all lines, as follows: Spikes, 1.90c to 2c; track bolts, 2.30c to 2.45c; splice bars, 1.75c to 1.90c; links and pins, 2c to 2.15c.

BARS.—The market is very strong. Prices are quoted 1.90c to 2c for steel bars, and 1.70c to 1.80c for iron bars.

STRUCTURAL MATERIAL.—The structural market is very firm and active. Prices are for the present unchanged, but a meeting is to be held in a few days at which the advance of probably $2 a ton will be made. We quote for the present as follows: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.05c; and angles, 1.50c to 1.55c; universal mill plate, 2c.

PLATES.—As already noted, the situation may be eased off a trifle by the starting of two plate mills in this district idle for many years, adding, say, 150 tons a day to the supply. The market is very firm, and it is reported that as high as 2.25c has been paid for tank plate, but the market remains as follows: Tank, 2.10c; shell, 2.20c; flange, 2.30c; fire box, 2¼c to 3¼c.

PIPES AND TUBES.—There is scarcely any merchant pipe to be had, and prices are practically nominal. Mills are very well filled with orders, and claim that they could not in any case take more orders at former prices considering the position at present of raw materials. Last week a meeting was held at which the discounts on casing were reduced by 5 points, equivalent to an advance of a trifle over 10 per cent, and on Monday a further meeting was held advancing boiler tubes by reducing discounts all around 5 points, making advances averaging something under 10 per cent. We now quote prices as follows: Merchant pipe, base discount, 60 percent and additional discounts three 10's for less than carloads and three 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 45 for screw and socket joint and 40 for inserted joint, with 5 percent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 40 per cent; 1¾ to 2½-inch, 50 for iron and 55 for steel; 2¾ to 6-inch, 55 for iron and 57½ for steel, all with an extra 5 percent to dealers.

SHEETS.—Steady progress is being made on the project to consolidate the sheet mills and little now remains to be done. No formal statement is yet ready as to the capitalization, and in this regard the matter is wholly in the hands of the projectors. The consolidation will include all the sheet mills which it is desired to embrace. The market is very strong at formerly quoted prices, 2.80c to 3c for No. 28 common. Galvanized remains unchanged at 70 and 5 per cent off list, with a 15-cent freight allowance.

SPELTER.—The spelter market is about as last reported, the tone of the market being decidedly firm, though not stronger than last week. We quote St. Louis 6.60c to 6.70c; Pittsburg, 6.75c to 6.85c; and New York, 6.80c to 6.85c.

OLD MATERIAL.—There has been considerable movement in old material, but prices remain about as last quoted: New melting stock, $13.50 to $13.75; old steel rails, long lengths, $12.50 to $13; cut, $13 to $13.50; old iron rails, $17 to $17.50; wrought iron scrap, $14 to $15; cast borings, $8, net, Pittsburg; busheling scrap, $11 to $11.50, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12, gross; charcoal scrap, $13, gross; wrought turnings, $8.50 to $9, net, Pittsburg.

COKE.—The coke market continues very firm. Production is being shoved to the utmost. Occasional sales are being made at as high as $2.15 for furnace, while we quote the market as follows: Furnace, $2; crushed and foundry, $2.15 to dealers and $2 30 to consumers, all for strictly Connellsville coke.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World*, 1522 MONADNOCK BLOCK, May 25.

Pig iron was active last week, sales being much larger than for several weeks previous. Two of the consolidations were in the market for iron, the bar makers and the pipe makers, and the former placed large orders. In other lines the market was about as it has been for some time past, good demand, with mills unable to take all the business offered.

PIG IRON.—The Republic Iron & Steel Co. purchased a considerable quantity of iron last week, approximating 25,000 tons, from the various selling agencies. The larger part of this was Southern iron, it is understood. Considerable sales were made also to the malleable trade, aggregating a large tonnage. Other business, from gray iron foundries, in both large and small lots, brought the total business for the week up to something like 75,000 tons. This does not clear the market of inquiries, as besides a number of smaller buyers who have not filled their requirements the United States Cast Iron Pipe & Foundry Co. is figuring on a considerable tonnage which is expected will be placed before the end of the present week. Selling agencies are more firmly convinced than ever that there will be a shortage of iron this year, and indications certainly point that way. The furnaces are extremely independent, selling only to those customers they prefer, and on their own terms. They have no difficulty in securing the prices asked for their iron, and buyers in many cases would willingly pay even higher prices than are asked could they be assured deliveries according to their needs. Prices have remained unchanged in the week, with the exception that malleable Bessemer iron has been advanced to $16.50 a ton, and another advance will quite likely be recorded before the end of the week. Announcement has been made of an advance in Southern freights, to take effect June 30, of 15 cents a ton to points taking the Chicago rate. This will make the rate $3.65 after that date. We quote:

Lake Sup. Charcoal	$17 00 @ 18 00	Southern Coke No. 3	$15 00 @ 15 50
Local Coke Fdy. No. 1	16 00 @ 16 50	Southern No. 1 Soft	16 00 @ 16 50
Local Coke Fdy. No. 2	15 50 @ 16 00	Southern No. 2 Soft	15 50 @ 16 00
Local Coke Fdy. No. 3	15 00 @ 15 50	Southern Silveries	15 50 @ 16 00
Local Scotch Fdy. No. 1	16 00 @ 16 50	Jackson Co. Silveries	17 00 @ 18 50
Local Scotch Fdy. No. 2	15 50 @ 16 00	Ohio Strong Softeners	15 50 @ 16 00
Local Scotch Fdy. No. 3	15 00 @ 15 50	Alabama Car Wheel	17 50 @ 18 00
Southern Coke No. 1	16 00 @ 16 25	Malleable Bessemer	16 50 @ 17 00
Southern Coke No. 2	15 50 @ 16 00	Coke Bessemer	17 00 @ 17 50

BARS.—A little selling was done last week, but no large sales were made by the Repbulic Iron & Steel Co. until the present week. In the past two days considerable business has been done and more is pending. The basis is 1.70c for iron and $1.80 for soft steel bars.

STRUCTURAL MATERIAL.—The week was quiet, with only a few

small sales of material. No large contracts were placed. The demand for steel is naturally small at this season of the year. The market is very strong, and what business is done is closed at full prices, and in many cases at something over quotations. Quotations are as follows: Beams, 15 inches and under, 1.65c to 1.70c; 18 inches and over, 1.75c to 1.80c; angles under 3 inches and over 6 inches, 1.75c to 1.80c; 3 inches to 6 inches, 1.65c to 1.70c. Sheared plates, 2.25c to 2.30c; universal plates, 2.25c to 2.30c; tees, 1.70c to 1.75c; zees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

BILLETS AND RODS.—Sales of steel were very small last week. The local mills are only taking care of regular customers, and find it sometimes difficult to do this. Billets are quoted at $28, and rods $37 to $38.

PLATES.—There has been no change in the situation. Sales from store are good, and mills still refuse to consider business, being sold ahead so far. Quotations are unchanged as follows: Tank plates, 2.25c to 2.30c; flange steel, 2.35c to 2.45c; marine steel, 2.45c to 2.55c; fire box steel, 3c and upwards.

SHEETS.—Mill orders are still limited, the mills not being in shape to make deliveries. Store business was good in the week, and included several quite large orders. Prices are made at 2.85c to 2.90c for No. 27 black, and 70 and 10 to 75 per cent off for galvanized.

MERCHANT STEEL.—Sales from store are excellent, and included three or four round lots. Mill business is quiet, owing to the inability of the mills to make required deliveries. Quotations are as follows: Open-hearth spring, tire and machinery steel, 2.40c to 2.45c; smooth-finished machinery steel, 2.45c to 2.55c; smooth finished tire steel, 2.25c to 2.35c; tool steel, 6c to 7.50c; special, 10c and upwards.

RAILS AND TRACK SUPPLIES.—Sales last week were limited to comparatively little business in light rails. We quote: Standard section rails, $26 to $27; light rails, $30 and upwards; steel splice bars, 1.40c to 1.50c; track bolts with square nuts, 2.15c to 2.25c; hexagon nuts, 2.25c to 2.30c; spikes, 1.85c to 1.90c.

WIRE AND WIRE NAILS.—There has been no change in the week. Sales are large, and give every indication of continuing so. Quotations are unchanged as follows: Plain wire, $1.95; galvanized No. 14 and heavier, 50c advance; Nos. 15 and 16, 85c advance; Nos. 17 and 18, $1.10 advance; wire nails, $2.10; barb wire, painted $2.20; galvanized, $2.70. All prices are f.o. b., Pittsburg, and on carload shipments all rail freight is added, making a delivered price. Single carload lots are quoted 10c higher.

SCRAP.—General business was light, with comparatively small sales. Some demand for mill iron is noted, and sales of this character are expected to be very much larger within a short time. Dealers' selling prices are about as follows:

Old iron rails, gross,	$18 50@$19 00	Axles, net	$19 00@$20 00
Old steel rails, long, gr.	13 00@ 13 50	Cast borings, net	6 00@ 6 50
Old steel rails, short	11 50@ 12 00	Wrought turnings, net	8 50@ 9 00
Old wheels, gross	16 50@ 17 00	Axle turnings, net	10 00@ 10 25
Railroad forge, net	16 50@ 17 00	Mixed steel, gross	8 00@ 8 50
Dealer's forge, net	12 00@ 15 00	Over plates, net	9 00@ 9 50
No. 1 mill, net	10 50@ 11 00	Heavy melting steel, gr.	10 50@11 00
Heavy cast, net	13 00@ 13 25	Old iron splice b., net.	18 50@19 00
Malleable cast, net	8 50@ 9 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., May 24.

The strike of the grain handlers at Buffalo, which included also the ore unloaders, is ended and the freight situation will have a chance to work toward a normal basis. The rate from Duluth is 75 cents, from Marquette 65 cents, and from Escanaba 60 cents, with nothing doing at Marquette and comparatively little from the other ports. About the usual proportion of ore is going on Lake Erie docks, direct shipments being restricted in about the way noticed last year by the limitations upon the car supply. The interest taken in long unworked Lake Superior mines is still a feature of operations there, as is the effort of large producers to get control of the comparatively few properties that are still in the independent list. Some attention is being given to Champion Iron Co. stock, which has led to the report of negotiations for control of the company. Nothing definite has come of this, however.

PIG IRON.—Sales of Bessemer iron in the past week reach a considerable total. The leading Pittsburg interest has taken in all 51,000 tons at $16, valley furnace. Another large company made inquiry but concluded not to buy at $16. Some iron has been sold for delivery in the third quarter by other than association furnaces, and it is reported that $16.50, valley, has been paid the past week for some of this iron. A meeting of the Bessemer furnace men is being held in Cleveland to-day for a discussion of the situation and for action that will fix the status of the association's operations for some time. It is thought probable that $17, valley furnace, will be the price of the next iron sold. There is now less than 60,000 tons of the estimated production of the Bessemer furnaces in the balance of the year that is unsold. The needs of steel works that are already in the shape of informal inquiries are in excess of this amount, and it is simply a question of the size of the shortage. Increasing ferro and spiegel production in the Pittsburg district will occupy one or two furnaces heretofore on Bessemer, and the heavy demand upon merchant furnaces is expected to be an important factor in the first part of the coming year, though thus far no inquiries have been received for Bessemer iron for 1900 delivery. Foundry buying in the Cleveland district has kept up steadily in the past week, the deliveries asked being for the remainder of the year. For No. 2 iron $15.75 and $16 have been paid. Gray forge from Southern furnaces is now $14.95 delivered in the valleys and $15.35, Pittsburg. The advance of the week is 25 cents in both foundry and mill irons. Purchases for the valley rolling mills and for the pipe foundry in Cleveland are now made through Chicago offices of the consolidated companies. Malleable works are reported in the market. We quote the Cleveland market:

Bessemer	$17 65	Valley Scotch No. 1	$16 65@17 15
No. 1 Strong Foundry	16 65@17 15	Valley Scotch No. 2	16 15@16 65
No. 2 Strong Foundry	16 15@16 65	Gray Forge, valley	14 75@15 00
No. 3 Foundry	15 65@16 15	Lake Superior Charcoal	17 00@18 00

FINISHED MATERIAL.—There is no change in conditions, the steady inflow of mail orders keeping up, with prices on the basis noted last week. Sales are being made by the Republic Iron & Steel Co. on the basis of 1.05c carloads, valley mill, for iron. Steel bars are quoted from 1.75c to 2c, Pittsburg, according to delivery and the condition of the mill. Some sales of open-hearth material have been made in the local market. Structural steel is unchanged at 1.50c, Pittsburg, for beams and channels, and 1.50c to 1.65c for angles, the smaller sizes being, as before, particularly scarce. We quote sheets at 2.95c, Pittsburg mill, for No. 27 black, there being no disposition apparently to refuse business because of the pending consolidation. Mills not covered for sheet bars face a high cost after the middle of the year, $30 having been paid in the Pittsburg district. The demands upon the plant of the American Wire & Steel Co. continue heavy. It is the expectation that large additions will be built to the open-hearth capacity of the Cleveland Rolling Mill Co.'s plant and that work will begin at once. The demand for open-hearth rods and wire is steadily on the increase. We quote smooth wire at $1.95, Pittsburg, in carload lots to jobbers, and $1.97½ in less than car loads; the prices to retailers being $2.05 and $2.15, respectively. Barb wire is $2.20, Pittsburg, for painted, carload lots to jobbers, and $2.70 for galvanized. We quote wire nails at $2.10, Pittsburg, in carload lots to jobbers, and $2.12½ in less than car loads.

CINCINNATI.

May 23.

The situation in regard to foundry iron has now become acute. Up to a few days ago mill iron was still to be had in comparatively fair quantities for almost any delivery. This came from the fact that during the earlier stages of the buying movement no mill irons at all were sold, the demand at that time being altogether for soft metals and partly from the fact that of late most of the Southern furnaces have been making a great deal more mill iron than is ordinarily the case. This state of affairs resulted in a shortage of foundry iron, and not exactly an excess of mill iron but the making of more mill iron than was expected. Consequently there has been gray forge and mottled to sell, but now it is simply out of the question to get any large quantities of standard Southern foundry irons for shipment within two or three months, while some furnaces are practically out of the market for the balance of the year. Prices went up to $12 firm for No. 2 foundry last week, while gray forge and mottled are now being held at $11, Birmingham. There is every indication that the next few days are to be days of activity and excite-

ment in the market. Last week was one of growing strength. Buyers, who, a few weeks ago were claiming that the additional tonnage of the furnaces that were to be put in blast would soon break the market, are now trying, in many cases too late, to get iron. We quote: Southern coke, No. 1 foundry, $15.25; No. 2 $14.50 to $14.75; No. 3, $13.75 to $14.25; No. 4 and gray forge, $13.50 to $13.75; mottled, $13.50 to $13.75; No. 1 soft, $15.25; No. 2 soft $14.50 to $14.75; Lake Superior coke, No. 1, $16.25 to $16.50; No. 2, $15.75 to $16; Hanging Rock charcoal No. 1, $20 to $21; Jackson Co. silvery No. 1, $18; Standard Georgia car wheel, $16.25 to $16.75; Lake Superior charcoal, $20 to $10.50.

SET C OF A. F. A. TEST BARS.

In our issue of May 4 we had space to give only the results of the compressive tests of the test bars of Set C of Dr. Moldenke's committee on a uniform standard of testing for cast iron. As stated, the set of 193 bars, cast under the same conditions as the two sets already published, were from iron suitable for light machinery. The composition was as follows: Total carbon, 3.84 per cent; graphite, 3.52; silicon, 2.04; manganese, .39; phosphorus, .578; sulphur, .044. The compressive tests, summarized May 4, showed a strength of 38,500 pounds for a half-inch cube from the middle of a half-inch bar, and gradual decrease to 14,220 pounds for a half-inch cube from the middle of a 4-inch square bar, indicating how much the size of a specimen has to do with its strength under test. The results of the tensile and transverse tests of Set C are as follows:

TENSILE TEST, BARS IN GREEN SAND.

Square:—From a maximum of 18,960 lbs. per sq. in. for the ½-inch bar down to 10,720 lbs. per sq. in. for the 2-inch, all rough castings; and 19,360 lbs. per sq. in. for the 1 in. machined down to ½-inch and 9,390 lbs. for the 2-inch machined down to 1½.

Round:—Here the figures run 18,680 lbs per sq. in. for the smallest to 11,740 lbs. for the heaviest bar, rough; and similarly 18,880 to 10,220 for the machined.

TENSILE TEST, BARS IN DRY SAND.

Square:—From a maximum of 17,040 lbs. per sq. in. for the ½-inch bar down to 10,810 lbs. for the 2-inch, all rough castings, and 18,760 lbs. for the 1-inch cut down to ½-inch, and 9,320 lbs; for the 2-inch machined to 1½-inch.

Round:—Here the figures run 19,100 lbs. per sq. in. for the smallest to 10,920 lbs. for the heaviest bars, rough; and similarly 18,760 and 9,760 lbs. for the machined.

TRANSVERSE TEST, BARS IN GREEN SAND.

Square:—With 12-inch supports the ½-inch bars broke with a maximum of 430 lbs. and showed a deflection of .204 in. It took over 105,000 lbs. to break the 4-inch bar, the deflection being .042 in., all rough bars. The 1-in. bar machined down to ½ in. broke at 730 lbs. and the 4-in., machined down to 3½-inch, broke at 65,140 lbs. with deflections .299-in. and .068-in., respectively.

Round:—Here the figures run 390 lbs. with 168-in. deflection to 105,010 lbs. with .041-in. for rough bars, and 330 lbs. with .312-in., and 73,930 lbs. with .072-in. for the machined.

TRANSVERSE TEST, BARS IN DRY SAND.

Square:—With 12-in. supports the smallest bar broke at 390 lbs. with a deflection of .209-in., and the largest bar at 102,520 lbs. with .062-in., all rough bars. The machined bars ran 670 lbs. with .318-in. deflection for the smallest and 60,110 lbs. with .075 in. for the largest.

Round:—Here the figures run 380 lbs. with .160-in. to over 105,000 lbs. with .040-in. for rough bars and 290 lbs. with .351-in. to 66,540 lbs. with .072-in. for the machined.

The Warwick Iron & Steel Co. has been incorporated under the laws of Pennsylvania with a capital stock of $1,500,000, of which $1,000,000 is to be issued at 105, the shares being $10, through H. F. Bachman & Co., of Philadelphia. The balance of $500,000 is to remain in the treasury. The company takes over the Warwick furnace, which has prospered under the management of Edgar S. Cook and Jacob Fegely for a good many years. The plan is to build a second modern furnace and the construction of a steel plant is a possibility. Edgar S. Cook will continue as president and manager.

THE NEW CARNEGIE STEEL CO.

The chief development of the week in the plans for the new Carnegie Steel Co. is the following statement given out by H. C. Frick at New York on Saturday:

"To set at rest the many erroneous reports regarding the capitalization of the proposed new Carnegie Steel Co., I desire to say it will be distinctly a home concern, embracing only the Carnegie, the Frick, and their allied interests and using a Pennsylvania charter. The capital will be $250,000,000, and but one kind of stock will be issued, fixed upon an investment basis, so that the present management will take their holdings in the stock of the new company."

PERSONAL.

James A. Campbell, for three years superintendent of the Mahoning Valley Iron Co., Youngstown, O., has been appointed district manager by the Republic Iron & Steel Co., and will have charge of the mills formerly operated by the Mahoning Valley Iron Co., the Brown-Bonnell Iron Co., and the Andrews Bros. & Co., of Youngstown; the Atlantic Iron & Steel Co., of New Castle, and the Sharon Iron Works, of Sharon, Pa.

John A. Walker, vice-president of the Joseph Dixon Crucible Co., Jersey City, N. J., sailed this week for Europe.

E. A. Uehling, inventor of the Uehling method of casting and conveying metals, sails for Europe this week for an extended absence. He will be connected with the Uehling Co., Ltd., of England, and will make his headquarters at Middlesbrough, Eng.

W. H. Hassinger, of Birmingham, Ala., general manager of the Alabama Rolling Mill Co., has been appointed Southern district manager of the Republic Iron & Steel Co.

Robert Laidlaw, of the Laidlaw-Dun-Gordon Co., is soon to sail for Europe on an extended trip.

S. T. Wellman, of the Wellman-Seaver Engineering Co., Cleveland, will return from Europe early in June.

W. P. Pressinger, formerly connected with the Clayton Air Compressor Works, New York, has been made secretary and treasurer of the Pneumatic Supply and Equipment Co., of New York, recently formed to execute contracts for complete compressed air plants and for the use of compressed air equipment.

Walter Kennedy, consulting engineer, has opened offices at 631 Penn ave., Pittsburg, and will give particular attention to blast furnace, Bessemer and open-hearth steel works construction. He is the inventor of a new design of blast furnace charging apparatus, in use at several furnaces. Mr. Kennedy is vice-president of the new Empire Iron & Steel Co.

Wm. E. Taylor, formerly treasurer of the Union Iron & Steel Co., Youngstown, O., has been elected general manager of the mills of the American Steel Hoop Co. in the Mahoning and Shenango Valleys, with headquarters in Pittsburg.

J. C. Searight, of New Castle, Pa., has been appointed local superintendent of Thomas Furnace of the National Steel Co., at Niles, O.

Admiral Sasso, chief naval constructor of the Japanese Navy, was a guest of the Carnegie Steel Co. last week. He is making an extended tour of Europe and the United States.

Three German engineers, Messrs. Henkel, Ziervogel, and Ernst were in Pittsburg last week, and have left for a tour through Japan and China. They are interested in mining and in iron manufacture in Westphalia and Rhenish Prussia, and are making an investigation of mining iron and steel metallurgy.

THE reported consolidation of plow companies, announced in connection with a meeting of plow manufacturers at Chicago recently, is apparently a long distance from realization. The Chicago meeting decided on a 15 per cent advance in prices; but it is a question if the preliminary work in the way of securing options, etc., will result in the merging of interests. A number of important companies have not been approached in the matter.

Extensive repairs are being made to Bristol Furnace, Bristol, Tenn., preparatory to its going in blast under the ownership of the Carter consolidation of Virginia furnace, ore and railroad interests.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held Monday evening, May 22, with President Wm. Yagle in the chair. Over 30 members and visitors were present. After the approval of the minutes of the previous meeting as read by Secretary F. H. Zimmers, the names of the following persons and companies were presented as having been approved by the executive committee and were declared elected to active and associate membership respectively:

Active Membership.—William Moen, DeHaven & Co., Allegheny; Alonzo Kim, foreman Mesta Machine Co., South Side, Pittsburg; Wheeling Mold & Foundry Co., Wheeling, W. Va ; Samuel Weekes, Lorain Steel Co., Johnstown, Pa.; C. S. Birmingham, Pittsburg Lamp & Brass Co., Allegheny; Dave Carlin, Carlin Mfg. Co., Allegheny; Kinzer & Jones Mfg. Co., Pittsburg; John C. Meyer, foreman Thos. Marshall, Pittsburg.

Associate Membership.—A. H. Neal, Pittsburg; Reed F. Blair & Co., Pittsburg; L. K. Brown, Zanesville, O.; A. M. Ayers, Zanesville, O.; Robert B. Lean, Allegheny.

The following paper was then read by M. A. Moran, foreman of the foundry of the Keystone Bridge Works:

The Use of Sandless Pig Iron in the Foundry.

Doubtless one of the most important subjects before the foundrymen of the world to-day, is being earnestly discussed, and put to practical tests wherever possible, aiming to arrive at a conclusion, which will show the merits, or demerits of sandless pig iron in the foundry, as against the use of sand cast iron. Of course, foundrymen, who all their lives have judged pig iron by its appearance, do not look kindly upon a departure which at one sweep destroys the knowledge gained in a lifetime. Nevertheless, in these days of progress, many practical problems have been worked out successfully by the application of scientific methods to actual demonstrations, which show decided improvement over the old methods. And those who still cling to the old and out-of-date ideas, will sooner or later be compelled to withdraw from the race, from not having taken advantage of the experience acquired by their more progressive competitors.

Much has been said about sandless iron for the foundry, and in nearly every case it has been admitted that sooner or later the use of sand-cast pig iron will be a thing of the past, many agreeing that the proper way of making up a mixture should be by analysis only. It is an established fact, as many of you know, that there are great advantages in making steel from sandless iron. Likewise founders who have adopted sandless pig iron fully appreciate and admit that there is an advantage by its use; and were I able by this address to give you the experience I have had, I am quite sure those who are still skeptical would be convinced that sandless iron for the foundry with a mixture based upon analysis is the proper thing, and that by its use superior results are obtainable.

Doubtless many of you were of the same opinion that I was, before I went through the experimental stages—that iron cast in iron molds would be unfit for foundry use, believing that when so cast there would be a chill in the pig, which the foundrymen thought would follow into the castings made from it. I have learned, however, to my entire satisfaction that this is not the case. This can be seen by examining some of the samples I have brought with me, if you will take the trouble, and thus be relieved of any doubt. Several years ago we began to use pig iron cast in stationary chills with good results, but with the sandless pigs from the Uehling casting machine we get still better results. The iron is cleaner and more uniform. This is no doubt due to the fact that instead of running direct from the furnace into pig beds, it is collected in large ladles in which it is not only thoroughly mixed, but the impurities have time to rise to the top, carrying with them much of the sulphur and all the slag, etc. The iron furthermore is absolutely free from sand and scurf, and for that reason comes much cleaner from the cupola. We have used nothing but sandless pig iron in our foundry for the past two years.

We make all kinds of machinery castings, some of which are quite thin, and require very fluid iron. The pig metal we use averages 1.00 to 1.50 in silicon, graphite carbon 2.85, combined carbon .45, sulphur not to exceed .03. My foundry record, for the period during which we used nothing but sandless iron show fewer bad castings and considerable economy in fuel and time. We get hot metal by using one pound of coke to 10½ pounds of metal. When we were using sand iron the ratio was 1 to 7. In fluxing we now use 100 pounds of limestone for 20 tons of metal, while when using sand iron it required 150 pounds of limestone for 20 tons of metal. Our cupola does not choke or slag, and we run the 20-ton heat without waiting for metal. The average loss between the iron weighed into the cupola and that of the castings was 6.43 per cent. in 1898, and the average amount of bad castings was 1.65 perc ent. The shrinkage is considerably less than what it was when running on sand iron, we now make our patterns allowing 1-16-inch to the foot for shrinkage. This I believe is less shrinkage than is generally expected in the average foundry. Our experience with sandless pig iron in the foundry is so satisfactory that we shall not voluntarily return to the use of sand iron. There is a large economy in fuel, economy in flux, more prompt and satisfactory melting, a saving in time, reduced wear and tear, and a less per cent of defective castings.

Discussion.

Dr. Moldenke said he could not see why the use of sandless pig iron should reduce the shrinkage of castings. He asked if the same amount of coke was used as before, with the sand cast pig.

Mr. Moran: We do not need to use so much. The heat does not have to go through sand and dirt, and the coke seems to take better hold of the iron.

Dr. Moldenke gave it as his experience with the harder irons that there would be a great difference in the grain of the castings between a mixture of half pig and half scrap, and a mixture of one-fourth pig and three-fourths scrap, and Mr. Moran explained that in making racks for bridges they had to use all pig, and the rule of 1-16 inch to the foot for shrinkage came out all right. These racks had to be very exact.

Mr. Kebler said that the small shrinkage was in all probability due to the low sulphur and phosphorus in the sandless pig being used. He understood this pig had formerly been used only for the basic open-hearth process, and for that reason they had been using an extra amount of limestone in the blast furnace, which gave low sulphur and rather low silicon, while this kind of iron would naturally have a small shrinkage. Supplementary to this, Dr. Moldenke claimed that even with the same chemical analysis, different physical treatment makes a difference in results, as to shrinkage for example.

In answer to a question Mr. Moran said there was no difference in the scrap carrying power made by using sandless pig. In his own foundry they carry their own scrap, sprues, worn-out hammer dies, old machinery, etc. They melted from 18 to 20 tons a day, and followed the rule of 1-16-inch shrinkage all the way through.

A member here stated that in some cases, with sand cast pig iron, no shrinkage at all is allowed, and in other cases the rule is only 1-16inch.

Mr. Sleeth asked if at the Keystone Bridge Works foundry they had ever cast between yokes, so as to get an exact result, pointing out that in some cases castings came out larger than the pattern, with any kind of iron, because through ramming out the mold would be larger than the pattern. It developed that the experiment of casting between yokes, to determine exactly the shrinkage, had never been tried, and in answer to questions Mr. Moran further stated that they had made housings weighing six or seven tons with this iron. They had not noticed so much scum on the iron in the ladles as before the adoption of the sandless pig. It was here stated that members had noticed quite a scum on the ladles with pig cast in the old stationary chills, which had been tried at a number of furnaces. In puddling with chilled iron it was remarked that the iron would be brought to "nature" from 15 to 20 minutes sooner than with sand cast iron.

The second paper of the evening was by Armin Schotte on "Modern Foundry Buildings," which elicited also an interesting discussion. This, with the paper, will appear in our next issue.

President Yagle congratulated the Pittsburg Foundrymen's

Association on having entertained the best and largest meeting yet of the American Foundrymen's Association, and he said he learned from visitors that all were highly pleased with the convention. Mr. Seaman spoke of the work which should be done by this association in organizing kindred ones, so that there would be a still better attendance at the next national convention, wherever it will be held. On motion of Mr. Seaman, the secretary was instructed to write letters of thanks to the various persons and concerns contributing in different ways to the success of the convention; to those who had loaned the interesting exhibits, to the typewriter people, the telephone company, and the donors of the many things which had helped to make the time enjoyable, including the Westinghouse Air Brake Co., which furnished the special train on Wednesday afternoon. A letter was read from former Secretary Penton, in which he said he felt it a duty he owed himself and the Pittsburg Foundrymen's Association to express his great appreciation of the courtesies extended him during the convention, and that he never had received so many favors nor had seen so many busy men give up their regular work for such a purpose.

A LONDON INTERVIEW WITH MR. CARNEGIE.

The following extracts from an interview with Andrew Carnegie, which appeared in the May 12 issue of the London *Iron and Coal Trades Review*, contains interesting information relative to the present status of the Carnegie Steel Co. and the enormous tonnage expected, on the completion of the open-hearth plant now under way. Mr. Carnegie's comment on the recent statements in these columns concerning the almost complete pre-emption of large Lake Superior properties by the leading steel companies, and his intimation that steel manufacturers will carry their operations still farther down the line of construction work, are important features of the interview.

"As you will have heard," said Mr. Carnegie, "I have actually disposed of my interest in the Carnegie Steel Works to my partners. I have nothing to do with any syndicate that may be formed. I was not anxious to sell, although I always intended to retire before I was an old man. The papers say the price to be paid is over 300 millions of dollars—about 63 millions sterling."

"Is that not an enormous figure?"

"No doubt it seems so, but you must not overlook the fact that the Carnegie Co. has the greatest coke properties and iron mines in the world. It is largely due to its splendid organization that the Carnegie Steel Co. has been so successful."

"Your steel output for the current year will beat the record, will it not?"

"Yes, we anticipate that from mid-summer next we will be making about three million tons a year of steel by the Bessemer and open-hearth processes, of which perhaps about a million tons will be open-hearth steel. We have now got at Homestead the largest open-hearth plant in the world. And we are speedily laying ourselves out for the manufacture of basic steel. Our recent mineral purchases have been made with a view to carrying on the basic process more extensively."

"You have, I believe, taken up the principal available mines in the Lake Superior region, as well as the best field of coking coal in the Connellsville field?"

"Yes; we believe we have got the best and the most productive mines on the Mesabi range, and elsewhere. We require ore sufficient to produce nearly three million tons of pig iron a year. No one now entering on the business could, in my opinion, secure any similar properties, and we have them on favorable terms as to royalty, etc."

"Can you tell me about your cost of transport? I understand that when you built your new line from Conneaut to Pittsburg you estimated you could carry the ores for one-seventh of a penny per ton-mile"

"We can do it for less than that. We can haul the traffic the whole distance of 152 miles for 12 cents, this figure being that of the cost of movement, and the interest on the investment may mean 12 cents more. Then there is the return haulage, which is largely, but not wholly, composed of empties, but what loads we get will, we think, pay the cost of the return of the empties."

"Is there any likelihood of the existing consolidations having to face the competition of new properties?"

"I do not think so—to any extent. The fact is, as has been reported that such properties would have difficulty about their ore and coke supplies. All the best properties on Lake Superior are taken up, and that region, and not the South, must provide the bulk of the future supplies of ore for the manufacture of cheap steel, both for home consumption and for export A recent writer has pointed out that one large group on the Marquette range, and one important mine on the Menominee range are about the only properties of any size that could be possibly picked up by a large consolidation in search of new mineral properties, and I agree with him. Most of the remaining mineral properties on the old ranges of Lake Superior are unimportant in respect of size."

"Then it looks as if we were not likely to witness a repetition of the low prices of the last two years?"

"That is difficult to say. I am inclined to think that we shall not see such a low range of prices permanently; but there must always, of course, be ups and downs in the future, as there have been in the past. The fact that most of the properties are now in few hands will be likely to keep up prices in the United States, and the ore problem must exercise an increasingly important influence."

"But you look forward to the United States continuing to produce iron and steel at a relatively low cost?"

"No doubt, so far as the most favorably situated works are concerned, and in my opinion the best situated will continue to be Pittsburg. But there will always be a considerable home demand in Great Britain, which we are not likely to affect."

"Of course, the American demand is likely to expand also—in shipbuilding, for example?"

"Yes; the shipbuilding of the United States is certain to become a great industry. Did you not see the other day that arrangements had been made for the building of an extensive new shipyard near to Philadelphia? That is but the beginning. The American shipbuilding industry will rapidly increase."

"But is it not probable that, even if all other circumstances were specially favorable, the command of skilled labor would prove a difficulty?"

"I don't think so; we have plenty of skilled labor. The other day we built and launched two of the finest warships in the world. The American artisans have high intelligence, and readily adapt themselves to new conditions."

"You have not connected yourself with any shipbuilding enterprise."

"No; our business has been to supply materials, and not to build ships. But I would ask you to remember that the American shipbuilder has not only the command of cheaper metals, but of cheaper timber as well, and that is a most important consideration, the cost of the timber entering into a modern vessel of the highest class being very large."

"Will you be connected with the new proprietary?"

"Not at all. I have retired from the business entirely. I am now about to take up other matters, in which I have long taken an interest."

"You have been undertaking considerable new developments at Pittsburg lately?"

"Yes, we have been erecting several new departments, including what I believe will be the largest axle factory in the world. Why, it may be asked, should steel-makers make plates for other firms to work up into boilers, when they can manufacture the boilers themselves Or beams and girders for bridges, when they can turn out and build up the completed article, or plates for pipes when they can make the pipes? I think the next step to be tken by a steel-makers will be to furnish finished articles ready for use. In the future the most successful firm swill be those that go to the farthest in this direction."

The Drake & Stratton Co. has been awarded the contract by Laughlins & Co., Ltd., for the erection of 800 large beehive coke ovens at the Eliza Furnaces, Second ave., Pittsburg, to cost $400,000. The erection of these ovens will consume over a year.

OUR LARGE EXPORTS AND SMALL IMPORTS OF IRON AND STEEL.

Our export trade in iron and steel and manufactures of iron and steel aggregated in value in 1898 $82,771,550, against $62,737,250 in 1897, and $48,670,218 in 1896, showing an increase in two years of more than 70 per cent. Included in the exports of 1898 were 253,057 tons of pig iron, 291,038 tons of steel rails, 28,600 tons of ingots, blooms and billets, 18,510 tons of steel wire rods and 24,195 tons of other steel rods and bars, 27,075 tons of steel plates and sheets, 74,665 tons of wire, 15,735 tons of cut nails and spikes, 13,714 tons of wire nails and spikes, and 34,038 tons of structural iron and steel. We also sent abroad in the same year 580 locomotives. Other exports embraced large shipments of machinery composed mainly or wholly of iron and steel. Agriculturalimplements are not included in the above figures. Of these the exports in 1898 amounted to $9,073,384, against $5,302,807in 1897, and $4,643,729 in 1866.

Our imports of iron and steel have greatly declined in late years. With the exception of tin plates, the importation of which is encouraged by an objectionable drawback provision in our tariff legislation, we now import very few of the products of European iron and steel works. In 1898 our total imports of iron and steel and manufactures of iron and steel amounted in foreign value to $12,473,637, against $13,836,204 in 1897, $19,462,561 in 1896, and $25,772,136 in 1895. Prior to 1895 our average annual importations of iron and steel from 1871, a period of 24 years, amounted to $42,826,681 in foreign value.

In 1880 this country imported iron and steel and manufactures of iron and steel valued at $80,443,362 and exported like articles of the value of $15,156,703. In 1898 we exported iron and steel and manufactures of iron and steel valued at $82,771,550 and imported, as stated above, like articles valued at $12,473,637, thus completely reversing the conditions of 18 years ago.

A Growing Trade With England.

In 1897 and 1898, and particularly within the past few months of 1899, English iron and steel and machinery manufacturers have been startled by a series of surprises which have marked the entrance into their own home markets of formidable American competition in lines that had previously experienced only fitful Continental competition. That a far-away country with a protective tariff should build up iron and steel industries that would beard the British free trade lion in his den is a revelation that they had not dreamed of. But the unexpected has happened. In the period mentioned this country has shipped directly to the United Kingdom considerable quantities of pig iron, steel billets, steel rails, steel plates, structural steel, wire rods, wire nails, and cast iron pipe, and more recently it has received orders for forty locomotive to be used on two of the great railways running from England to Scotland, the Midland and the Great Northern. More remarkable still, in February last the British Government itself ordered a steel railroad bridge of American design and construction, consisting of seven spans of 150 feet each, to be built across the Atbara river, in the Soudan country, south of Egypt. American steel rails and locomotives have recently been shipped to India and Australia. The owners of the Baldwin Locomotive Works, of Philadelphia, are now filling an order for 45 locomotives for railroads in India that have been built with English capital. That American exports of all the articles mentioned above, and of others that might be mentioned, will be continued to the United Kingdom itself and to the British colonies on the other side of the globe there can be no room for doubt.

An interesting feature of our foreign iron trade is disclosed by a careful examination of the statistics of our imports of iron and steel and manufactures of iron and steel from Great Britain and our exports of like articles to the same country, tools and machinery being included in both cases. These statistics show that our imports of iron and steel and manufactures of iron and steel from Great Britain in the fiscal year ended June 30, 1898, including tin plates, amounted in value to $8,360,866 and that our exports to Great Britain in the same fiscal year amounted to $12,752,016. The weight of all the articles both imported and exported is not a matter of record, but, considering only those articles imported from Great Britain in 1898 which were weighed, tin plates included, and the corresponding articles exported in the same year from this country to Great Britain, we find that we imported 119,189 gross tons and exported 118,232 tons. Only a few years ago this country was Great Britain's principal customer for iron and steel, but now we sell her in her own home markets virtually as much iron and steel as she sells to us.

Future of Our Export Trade.

The immediate future of our export trade in iron and steel, which trade has been a factor in bringing about the present improved condition of our iron and steel industries, need not cause apprehension, notwithstanding our enhanced prices. Under any circumstances we will continue to export large quantities of leading iron and steel products to Canada, Mexico, the West Indies, and Central America, while the high prices for iron and steel that now prevail in European countries will help us to maintain our present advantage in all markets. The excellent quality of our iron and steel products and our proverbial promptness in filling orders will also be powerful factors in enabling us to hold our present export trade in the cruder forms of iron and steel, as well as in locomotives and machinery generally. Nor can the day be very far distant when we will build iron and steel ships and naval vessels for all the maritime world. In this new branch of our export trade we have already made a good beginning in building first-class naval vessels for Russia and Japan. [From Advance Sheets of the Annual Report of the American Iron and Steel Association.

AMALGAMATED ASSOCIATION'S SCALE WORK.

The Amalgamated Association in convention at Detroit the past week has been making good headway in the various wage scales. Up to Monday evening of this week all the regular iron scales, including one finishing scale, had been completed. It is understood that the boiling scale has been fixed on a 1.3 rate for bar iron, instead of 1 cent, as at present, and that the minimum is $5 instead of $4, as under last year's card. The increase is 25 cents for each one-tenth advance in bar iron, making the other prices $5.25 with bar iron at 1.4 cent; $5.50, with bar iron at 1.5 cent; $5.75, with bar iron at 1.6 cent; $6 with bar iron at 1.7 cent.

It is reported that on the scrapping and busheling and the knobbling scales, an advance of 25 per cent is asked, as in the case of puddling. The knobbling scale provides the following rates for scrap per ton of 2,464 pounds: 1 cent bar iron $4.79; 1.1 cent bar iron, $4.92; 1.2 cent bar iron, $5.05; 1.3 cent bar iron, $5.14; 1.4 cent bar iron, $5.23; 1.5 cent bar iron, $5.33; 1 6 cent bar iron, $5.43. On refined iron the corresponding prices and rates are: 1.1 cent, $6.18; 1.2 cent, $6.30; 1.3 cent, $6.59; 1.4 cent, $6.75; 1.5 cent, $6.83; 1.6 cent, $6.98; 1.7 cent, $7.10.

The new basis adopted for the tin plate scale provides for a ratio of one-seventh between the price of sheet bars, 2,000 pounds, and a 100-pound box of tin plate. Any change in prices that changes this ratio calls for an advance of 5 per cent in wages for every $2 departure from the ratio, in favor of the manufacturer; for every $2 decline from the ratio wages decline 5 per cent. The base wages fixed in committee for the one-seventh ratio were an average of 9.1 % advance upon last year's. In the convention the radicals made a hard fight that lasted several hours, and finally, in the midst of a great uproar carried their point, defeating the committee's report and raising the advance to 20 per cent. It is evident that the men have decided to throw down the gauntlet the American Tin Plate Co.

The sheet mill scale was taken up on Tuesday, May 23. An average of about 11 per cent advance is asked, over last year's scale. The new scale is virtually that of 1893, which was reduced 10 per cent in 1894. The basis of the sheet mill scale is left at 2½ cents.

The Shelby Steel Tube Co. has purchased the Albany, Ind., Tube Works and the Pope Tube Works of Hartford, Conn. This gives the company 13 tube plants.

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AND
INDUSTRIAL WORLD.

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ECHOES OF THE PITTSBURG CONVENTION.

Soon after the adjournment of the convention of the American Foundrymen's Association at Pittsburg, last Thursday, Secretary Penton notified the executive committee that in view of his duties in other capacities he had thought best to resign his office, that his successor might be selected before the new execut ves separated. A meeting was called at once, and the deliberations resulted in the election of Dr. Wm. B. Phillips, of Pittsburg, as secretary. Dr. Phillips' abilities as a metallurgist and chemist are well known and he will undoubtedly bring to the new work his best endeavors. Mr. Penton has been the leading spirit in the association since its organization in Philadelphia in 1896. No man in the country has so wide an acquaintance among the foundrymen, and the work accomplished through his efforts, in building up the association through years not noted for the abundance of profits in foundry operation, could not have been duplicated, it is safe to say, under any other auspices. His ability to accomplish things undertaken has been of great value to the association and his withdrawal is a distinct loss. It is to be hoped that his co-operation and influence may still be assured in the movement in which he has been so conspicuous.

Arrangements had been made for a boat excursion Thursday afternoon, to visit the Homestead Steel Works and the Carrie blast furnaces of the Carnegie Steel Co., but on account of the rapid rise in the river during the previous night, and the further rise during the day, it was not considered advisable to take the boat out, and a trolley ride was arranged instead to the Homestead Steel Works. On the way back the cars were taken out to Calhoun Park, which lies on the branch road going to McKeesport. Here the body was photographed, two exposures each being made on large and smaller sized plates. Afterward refreshments were served. The visit to the steel works served only to convey a faint impression of the work being done, the visitors having to hurry through a portion of the works, all that the allotted time permitted. The body passed along one of the line of open-hearth steel furnaces and then, passing the buildings containing the machine shop and two Bessemer converters, to one of the blooming mills and the four-high plate mill.

Secretary Penton is an enthusiast in the collection of artistic castings in iron and bronze. His European specimens collected in the past year were brought together in one of the parlors of the Monongahela House, and throughout the convention the room was resorted to by interested foundrymen. Russian and German work was represented chiefly. There were plaques, pieces of armor, historic entablatures and other mural pieces that displayed marvelous ingenuity. The absence of any evidences of jointing in some of the most complicated of these castings was a matter of wonder. In addition several copies of statuettes, jewel boxes and ornamental cases, the originals of which were in gold, and made for royalty, were shown. The rustless finish of this work was a matter of comment. Beside the Penton collection, there were shown in the room devoted to art castings, some highly creditable work from the foundries of the Yale & Towne Mfg. Co., Stamford, Conn.; Magee Furnace Co. and Smith & Anthony Co., of Boston; F. & L. Kahn & Bros., of Hamilton, O.; American Radiator Co., Detroit branch; Michigan Stove Co., Detroit, and Chicago Hardware Mfg. Co., Chicago. A copy of the Declaration of Independence in relief, with signatures, was one of the Magee Furnace Co.'s pieces, and F. & L. Kahn & Bros. showed Da Vinci's "Last Supper" in bronze.

Chicago and Boston both make a strong bid for the convention of next year. Chicago, as the home of the Western Foundrymen's Association, the second of the district associations to be formed, asks for the meeting because it has been long in the movement, and four other points have been chosen in succession. Boston men urge that as New England has come for three years to the Middle West, it is in order for the West to go to the Hub. The decision is in the hands of the executive committee and probably will not be made until early in the coming year.

The ladies who accompanied members of the association to Pittsburg were delightfully entertained by the local committee of ladies. There was little unoccupied time and the excursions had more attractive objective points, to the feminine mind, than foundries and steel works.

There was not the usual amount of discussion on the floor of the convention, possibly owing to the fact that the debatable material had been well threshed over at previous meetings. But one feature of these gatherings, and one of the most valuable of all, is the off-hand interchange of experience among groups of founders and superintendents, in hotel corridors. It is more and more the practice of foundry firms to send their foremen and superintendents along with officers of the company, and to judge from the amount of good foundry method communicated by word of mouth in these free parliaments, the plan is likely to grow more popular.

The Baush & Harris Machine Tool Co., of Springfield, Mass., gave neat aluminum pen trays as souvenirs.

Oliver Iron Mining Co's Mines.

A. R. Peacock, James Gayley, D. M. Clemson, E. S. Mills, E. H. Utley, Dr. N. P. Hulst and Geo. E. McCague have gone to the Lake Superior region to inspect the ore properties of the Oliver Iron Mining Co. All the five ranges are represened in the list, which now includes the following:

Mesabi Range—Mountain Iron, Rathbun, Etna, Lone Jack, Mesabi Mountain, Norman.

Vermillion Range—Pioneer, Zenith, Savoy.

Gogebic Range—Norrie, East Norrie, North Norrie, North Aurora, Pabst, Tilden.

Marquette Range—Lake Superior group of five mines, (Hard Ore, Hematite, Chicago, Section 16, Section 21), and Buffalo, North Buffalo, Queen, Prince of Wales, Blue.

Menominee Range - Iron River, Dober, Isabella, Miller.

OWING to the continued illness of P. G. Cochrane, president of the Washington Coal & Coke Co., the board of directors at a meeting held at the company's Dawson office, on May 20, created the office of vice-president, and J. R. Laughrey, formerly treasurer of the company, was elected to fill the position. The offices of secretary and treasurer were combined and John H. Wurtz elected as secretary and treasurer

"D," who may be addressed at the office of *The Iron Trade Review*, wants the address of a manufacturer of steel singletrees, double-trees, and neck yokes.

American Foundrymen's Association at Pittsburg.

The fourth of a remarkable series of gatherings, of which the first was the organization meeting in Philadelphia three years ago, the Pittsburg convention of the American Foundrymen's Association was noteworthy for the largest attendance in the history of the association movement. With more than 250 registered attendants from outside the Pittsburg district and nearly as many more from Pittsburg and outlying industrial towns, the convention was a fair exponent of what the awakening of interest in foundry progress has come to under three years of well directed effort. The hospitality of the Pittsburg entertainers was open-handed and unstinted. Praise of their generous and well-planned efforts was everywhere heard; and the Pittsburg foundrymen may take satisfaction from knowing that their meeting has been a distinct help to the association, and has set it well on its way for an increase in membership and influence in the coming year. Pittsburg is so important a center of iron and steel operations that it was not difficult to persuade foundrymen to make the trip—those of them who could shift the burden of shop operations for a few days. Many were kept at home by the pressure of work—the first time in the association's history that there has been any such obstacle.

Additional Registration.

Besides the names of members and visitors reported last week, the following were registered on Wednesday and Thursday, May 17 and 18.

W. Hanson, Pennsylvania Iron Works, Philadelphia; E. E. Hanna, Gates Iron Works, Chicago; Stanley G. Flagg, Jr., Stanley G. Flagg Co., Philadelphia; W. Strangward, Forest City Foundry & Mfg. Co., Cleveland; James A. Beckett and Enrique Tonceda, Walter A. Wood Co., Hoosic Falls, N. Y.; A. H. Blackburn, Fuel Economizer Co., Matteawan, N. Y.; W. G. Harker, Knott, Harker & Co., Beaver Falls, Pa.; A. G. Hubbard and C. A. Shanklin, Wheeling Mold & Foundry Co., Wheeling, W. Va.; T. I. Rankin, Abram Cox Stove Co., Philadelphia; H. C. Shaw, Lewis Foundry & Machine Co., Pittsburg; D. G. Moore, Samuel Moore & Sons Co., Elizabeth, N. J.; Harris Tabor, Tabor Mfg Co., Elizabeth, N. J.; T. H. Asberry, Enterprise Mfg. Co., Philadelphia; Amos Walder, Genesee Foundry Co., Rochester, N. Y.; J. M. Atcheson, H. C. Frick Coke Co., Pittsburg; George H. Barbour, Michigan Stove Co., Detroit, Mich.; J. M. Sloan, Redstone Oil & Coke Co., Pittsburg; L. H. Hiller, J. H. Hillman & Co., Pittsburg; Andrew C. Daft, Reed F. Blair & Co., Pittsburg; C A. Hamilton, Deane Steam Pump Co., Holyoke, Mass.; Richard Garlick and H A. Strauss, Lloyd Booth Co., Youngstown, O.; David Carlin, Carlin Mfg. Co., Pittsburg; W. S. Elkins, Pennsylvania Car Wheel Co, Pittsburg; George S. Fisher, Fisher Foundry & Machine Co., Pittsburg; W. A. Herron, Lewis Foundry & Machine Co., Pittsburg, S. S.; W. J. Phillips, Phillips & McClaren Co., Pittsburg; George E. Brush and John A. Stevens, Brush & Stevens, Pittsburg; Geo. P. Bliss, Brittan & Mathes Co., Pittsburg; Geo. S. Houghton, H. C. Frick Coke Co., Pittsburg; C. P. Kruth, McConway & Torley Co., Pittsburg; L. A. Anshutz, Anshutz-Bradberry Co., Pittsburg; W. D. Burt, Enterprise Foundry Co., Allegheny; Robert Bentley, Ohio Iron & Steel Co., Lowellville, O.; T. E. Klauss, Kinzer & Jones Mfg. Co., Pittsburg; Donald Fraser, Northwestern Nail & Iron Co., Milwaukee; A. L. Fitzmaurice, J. D. Smith Foundry Supply Co., Cincinnati; W. J. McCormick, James Craig, Riter & Conley Co., Pittsburg; A. G. Barnett, Jr., A. Garrison & Co., Pittsburg; A. W. Cadman, A. W. Cadman Co., Pittsburg; J. D. Ford, Porter Foundry & Machine Co., Allegheny; Chas. S. Perrine, Crafton, Pa.; C. A. Sercomb, Milwaukee; F. A. Smythe and Chas. O. Ott, Lorain Steel Co., Johnstown, Pa.; A. E. Kornfeld, *Engineering News*, New York; A. I. Findley, *The Iron Trade Review*, Cleveland, O.; A. E. Doak, Whitehead Bros., New York; C. B. Crook, Lidgerwood Mfg. Co., New York; John Weink, Walworth Run Foundry Co., Cleveland, O.; C. S. Little, C. S. Little, Johnstown, Pa.; J. M. Tate, Jr., Tate, Jones & Co., Pittsburg; E. S. Dawes and W. A. Myler, Dawes & Myler, New Brighton, Pa.; Geo. W. Rode, Mutual Life Insurance Co., Pittsburg; T. A. Barker, A Bradley & Co., Pittsburg; H. S. Graff, Graff & Co., Pittsburg; J. L. Hukill, Fort Pitt Bronze Co., Pittsburg; J. C. Porter, and J. V. Smith, Porter Foundry & Machine Co., Allegheny; F. A. B. Ammon and Chas. McVay, A. Bradley & Co., Pittsburg; John C. Bash, Baldwin & Graham, Pittsburg; Jos Bell, Jos. Bell & Co., Wheeling, W. Va.; F. A. Neale, and H. J. Lindsay, Carnegie Steel Co., Pittsburg; Hugh McCulley and Hugh Kennedy, Jones & Laughlin, Ltd., Pittsburg; F. H. McClure, Robinson-Rea Co., Pittsburg; A. P. Patterson, S. K. Brown & Co., Pittsburg; Hon. John Bindley, Bindley Hardware Co., Pittsburg; G. A. Hogg and John C. Myers, Totton & Hogg Iron & Steel Foundry Co., Pittsburg; H. J. Taylor, Taylor, Wilson & Co., Allegheny; S. A. McRoberts, *American Manufacturer*, Pittsburg; W. W. Hearne, Matthew Addy & Co., Cincinnati, O.; Alex. Wilson, Rogers, Brown & Warner, Pittsburg; L. K. Brown, L. K. Brown & Co., Zanesville, O.; Jas. L. Morral and J. H. Hammond, Seaman-Sleeth Co., Pittsburg; C. Wike, Hall Steam Pump Co., Allegheny; W. R. Yagle, Wm. Yagle & Co., Pittsburg; R. S. Bosworth, Hugh Wadhams Co., New York; J. W. Conway, Pratt & Cady Co., Hartford, Conn.; Clar. H. Joslyn, Merrimac Foundry Co., Lawrence, Mass.; Michael Donlon, L. H. Goodnow Foundry Co., Fitchburg, Mass.; W. H. Stafford, Bausch & Harris Machine Tool Co., Springfield, Mass.; J A. Stone, Riverside Foundry Co., Cleveland, O.; B. Horbison, Fraser & Chalmers Chicago; C. E. Hoit, Chicago; H. Gossiger and Robert S Osworth, Eureka Foundry Co., Cincinnati; Lincoln Haney, Globe Foundry, Cincinnati; E. K. Rundle, Rundle-Spence Mfg. Co., Milwaukee; A. W. Bauer, C., M. & St. P. R. R., Milwaukee; F. W. Bauer, Warder, Bushnell & Glasner, Springfield; E. U. Scovill, E. U Scovill Foundry Co., Manlins, N. Y.; Geo. W Cope, *Iron Age*, Chicago; Jas. Denham, Taplin, Rice & Co., Akron, O.; J. A. Findley, Philadelphia Roll Machine Co., Philadelphia; C. M. Nichols, Benj. Nichols & Son, Jamestown, N. Y.; S. Watt, Watt Mining Wheel Car Co., Barnesville, O.; A. Eadie, Jas. Simpson & Co., London, Eng.; Geo. A. Moke, General Chemical Co., Pittsurg; A. G. Carleton, Bedford, Conn.; Jas. C. Alley, C. G. Paison & Co., Boston, Mass.; J. D. Armrod, Donaldson Iron Co., Emaus, Pa.; C. S. McCleery, McKeefrey & Co., Leetonia, O.; Ed. Caffey, Keystone Coal & Coke Co., Pittsburg; Wm. Seabright, Spence-Baggs Co., Martin's Ferry, O.; C. W. Baker, *Engineering News*, New York; A. H. McCall, Erie Foundry Co, Rochester, N. Y.; H. A. Uulf, Union Iron Works, San Francisco; W. A. Beckett, Totton & Hogg Iron & Steel Foundry Co., Pittsburg; H. P. Spilker and Chas. Baur, Sterritt & Thomas, Pittsburg; W. H. Harris, Standard Radiator Co., Buffalo; W. J. Naeser, Wm Yagle & Co., Pittsburg; A. Snyder, R. J. Wilson and J. H. Wilson, Wilson, Snyder & Co., Pittsburg; C. L. Schmick, Cherry Valley Iron Co., Leetonia O.; Ed McFarland, Mathew Addy & Co., Cincinnati; F. duP. Thompson, C. G. Hussey & Co., Pittsburg; F. W. Gould, Union Malleable Iron Co., Moline, Ill.; F. A. Williams, Youngstown Foundry & Machine Co., Youngstown, O; C. C. Smith, Union Steel Casting Co, Pittsburg; C. C. Ross, Geo. A. McLean & Co., Pittsburg; T. G. Stern, S. P. Haller, Pittsburg; W. Speer, Reliance Casting Co., Pittsburg; G. H. Marshall, Marshall Bros., Pittsburg; J. E. Williams, Springfield Foundry Co., Pittsburg; W. P. Bowney, Youghiohegeny River Coal Co., Erie, Pa.; S. V. Hunnings, Pittsburg Locomotive Works, Allegheny; W. H. Simmonds, W. H. Simmonds & Co., Pittsburg; J. T. Rowley, and W. B. Bishop, Bridgewater Steel Co., Bridgewater, Pa.; D. W. Loomis, S. H. Dickson, Pittsburg; J. V. Patton, Hastings Steel Co., W. Bridgewater, Pa.; C. T. Holbrook and F. B. Lott, Davis Coal & Coke Co., Philadelphia; F. A. Humphrey, Norton Emery Wheel Co., Worcester, Mass.; R. F. Blair, Chas. G. McKee, R. F. Blair & Co., Pittsburg; Wm. H. Kelly, Buckeye Engine Co., Salem, O.; R. L. Oberholser, Pittsburg Forge & Iron Co., Pittsburg; Alonzo Kim, Mesta Machine Co., Pittsburg; A. K. Beckwith, Estate of P. D. Beckwith, Dowagiac, Mich.; R. H. Boggis, and Taylor H. Boggis, Taylor & Boggis Foundry Co., Cleveland; R. M. Wallingford, Jr., Thomas A. Mack, Cincinnati; H. G. Lloyd, Eagle Emery & Corundum Wheel Co., Chicago, Ill.; Frank D. Kinser, Mahoning Foundry & Machine Co., Youngstown, O.; W. S. Pattin, Pattin Bros., Marietta, O.; W. E. Kanavel, E. M. Myers, Zanes-

ville, O.; Thos. J. Bradberry, Sharpsburg, Pa.; Isaac C Capron, Ashland Emery Mills, Perth Amboy, N. J.; Gust Bowman and W. E. Tremely, Jones & Laughlins, Ltd., Pittsburg; J. B. Munslow and O. Wilcox, Taylor & Wilson Co., Ltd., Allegheny; George Lees, Crescent Steel Co., Pittsburg; H. Wilson, Pennsylvania Car Wheel Co., Allegheny; David Justice, A. Speer & Sons, Pittsburg; Richard Muse, Thomas Marshall Foundry Co., Ptitsburg; J. R. Backofen, Westinghouse Electric & Mfg. Co., Pittsburg; Thos. Andrew, Thomas Marshall Foundry Co. Pittsburg; Peter Hartmann and S. H. Stevens, Kinser & Jones Mfg. Co. Pittsburg; William Valtt, Pittsburg Foundry & Machine Co., Pittsburg; J. H. McKinnie, Riverside Foundry, Pittsburg; F. J. Hepp, Westinghouse Electric & Mfg. Co., Pittsburg; A. F. Koons, Webster, Camp & Lane Machine Co., Akron, O.; C. W. Watson, Vulcan Iron Co., Ltd., New Castle, Pa.; H. C. Wiskittel, A. Wiskittel & Sons, Baltimore Md.; W. A. McElroy, Riverside Iron Works, Wheeling, W. Va.; Jas. Powell and Wm. Porteous, Wm. Powell & Co., Cincinnati; T. H. Gartland, C. M. Miller, Gartland Foundry Co. Cleveland, O.; J. A. Oberholmen, C. F. Thareld Co., Cincinnati, O.; Henry S. Schwargenberg, R. B. Seidel, Cleveland O.; W. A. Bole, Westinghouse Machine Co., Pittsburg; G. B. Morrow, Braeburn Steel Co., Braeburn, Pa.; J. S. Graham, and S. R. Baldwin, Baldwin & Graham, New Castle, Pa.; Wm N. Gartside, Diamond Clamp & Clasp Co., Richmond, Ind.; Thos. McKenna, A. & T. McKenna, Pittsburg; J. H. Bloger, Bloger Bros., Pittsburg; Thomas A. Orr, Robinson & Orr, Pittsburg; Chas. H. Bradley, A. Bradley & Co., Pittsburg; Orlando Miller, Westinghouse Air Brake Co., Pittsburg; Richard Yagle, Wm. Yagle & Co., Pittsburg; A. M. Spice, and Robert Schott, Sheffield, Eng.; W. J. Morton, Ohio Sand Co., Connant, O.; W. L. Scaife, Scaife Foundry & Machine Co. Pittsburg; W. A. Merritt, Lorain Steel Co., Johnstown, Pa.; Bayard Phillips, Phillips & McClaren, Pittsburg; James Dickson, Brittan & Mathes, Pittsburg; Albert W. Smith, Case School of Applied Science, Cleveland, O.; R. C. Hills Colorado Fuel & Iron Co., Denver, Col.; John A. Coyle, Mesta Machine Co., Pittsburg; S. C. Mason, E. M. Grove, McConway & Torley Co., Pittsburg; C. L. Baldwin, New Castle Engineering Co., New Castle, Pa.; J. M. Botsford, and A. R. Riley, Pittsburg Malleable Iron Co., Pittsburg; Emil Swenson, Keystone Bridge Works, Pittsburg; C. S. Rea, Mesta Machine Co., Pittsburg; F. E. Russell, F. T. Aschman & Co, Pittsburg; W. G. Lee, Specialty Mfg. Co., Allegheny; W. D. Berry, Fort Pitt Bronze Co., Allegheny; L. F. Denverman, D. W. Van Duzen Co., Cincinnati; H. G. Dravo, Allegheny.

TUESDAY EVENING.

The hall of the Monongahela House was filled on Tuesday evening when the two lantern slide papers of the convention were read. The first of these was by Arthur W. Walker, treasurer of the Walker & Pratt Mfg. Co., of Boston, describing the new factory plant of that company located in Watertown, Mass., near the Watertown Arsenal and said to be the finest stove foundry in the world The address was illustrated by over 100 stereopticon views showing the improved process of manufacture in these works.

The buildings described were erected in a part of a tract of some 40 acres, which is controlled by the company. The land not required for the manufacturing buildings has been tastefully laid out in streets and house lots for the homes of employes. The factory buildings are of modern one-story construction, admirably lighted and most conveniently arranged for the various processes in the manufacture of stoves and heating apparatus.

The main foundry building, in which the molding is done, is very liberally provided with windows and skylights, the area of glass being more than 35 per cent as large as the area of floor. A novel feature of these works is the overhead track, or railway, by which, suspended special from carriages, heavy loads may be moved. By this overhead track or trolley, all the molten iron is distributed about the foundry. It has been generally supposed that mechanical distribution of melted iron is not practicable, in stove foundries. This company, however has carried out the plan in a highly successful manner.

Mr. Walker described the improved cupola used, and many details of mechanical arrangements and labor-saving devices for handling materials; refinements which have not previously been used in foundries. The cupola charges of pig iron and fuel are handled on special roller-bearing cars of the company's design.

The company has taken an unusual position in providing exceptionally fine lavatories for its workmen. There are three toilet rooms, of which the main one is over 100 feet long, and 35 feet wide. In this room are 80 separate bathing rooms or closets, similar to those used in the best gymnasiums. Each of these 80 small rooms has hot and cold water faucets and clothes closets with lock and key. The molders bathe daily before leaving the works, and greatly appreciate the conveniences offered by the company.

The various steps in the production of stoves, furnaces and heating boilers were fully illustrated and described. The method of removing sand from castings, and polishing and nickel plating departments, the shops where the various castings are put together to make complete stoves, the large warehouse for finished goods and the buildings for the construction and storage of patterns were all shown and described in turn.

The company has undertaken to make its factory attractive in its surroundings as well as efficient in its methods of manufacture. The grounds about the building have been tastefully laid out under the direction of a landscape architect, and about 1,200 shrubs and trees have been planted. The company believes that for the production of a high grade of goods the health, comfort and even the convenience and taste of its employes must receive due consideration.

Mr. Walker's admirable address received the closest attention. The illustrations were particularly attractive. The speaker closed with an invitation to foundrymen and others interested in advanced shop practice to visit the works and see the improved construction and new features of manufacture.

W. J. Keep, superintendent of the Michigan Stove Co., read a paper on "Original Methods for Handling Materials at the Works of the Michigan Stove Co, at Detroit, Mich." It was illustrated, like Mr. Walker's, with lantern slide views, which gave a clean idea of the elaborate and economical system devised by Mr Keep for the handling of pig iron, coke scrap, sand and other materials at the works of his company. The portion of the paper describing the system, with views of the crane, tracks and other equipment, is given elsewhere in this issue. The evening was an exceedingly profitable one and of special interest to practical foundrymen.

WEDNESDAY, MAY 17.

The first paper of the second day of the convention was the report of the committee on Bureau for Standardized Drillings for Cast Iron, presented by the chairman, Thos. D. West. The work of the committee, as already detailed in these columns from time to time, was described by Mr. West, and the satisfactory results indicated. The standardized samples had been secured at a low cost and a large number of laboratories connected with steel works, blast furnaces, foundries and technical schools arenow making use of them. The committee was continued through the coming year, and on motion of F. W. Bauer, of Springfield, O., it was instructed to confer with the committee of the American Chemical Society, with a view to securing uniformity in methods of iron analysis.

The other papers of the morning were by James Powell, of Cincinnati, on "The History and Technics of Bronze Founding," and by John M. Richardson, of Providence, R. I., on "Importance of Fillets and Round Corners on Modern Machinery Castings." The discussion following the latter was participated in by Messrs. S. Groves, of Pittsburg, West, President Bell, Dyer, of Chicago, and Fuller, of Pittsburg.

At the Westinghouse Air Brake Works.

In the afternoon, by courtesy of the Westinghouse interests, visits were made to the air brake works at Wilmerding and the engine works at East Pittsburg. The visitors were taken by special train first to Wilmerding and then to East Pittsburg, where refreshments were served. The foundry of the air brake works was inspected with the greatest interest, the machinery to expedite the turning out of castings being a marvel to most of the foundrymen. The general sameness of the work has permitted the reduction of the operations to a

system in which most of the work is done by machinery. There are four cupolas, one of which is kept in reserve. Each of the other three is drawn from once in each 24 hours, the plant being run in night and day shifts of ten hours each, and continuous pouring is the rule. There are three conveyors with small platforms jointed together and mounted on rollers, making an endless connection, in the shape of two parallel lines, close together, with a half round connection at each end. On one side the molds are placed as they are made, and as they travel around, they are poured on the other side. Two of these conveyors make a forward movement once in each seven minutes, while the other moves constantly at the rate of 24 feet a minute. Most of the molding is done by machine, and very rapidly, the machines being placed close to the conveyor. The cores are made in another place and carried to the conveyor, and each complete mold is built up by successive stages as it advances. The sand is carried to the machines by overhead conveyors. These consist each of a long trough, above which is a shaft which moves back and forth continuously, and has downwardly projecting flaps which yield when the shaft moves one way and become perpendicular to it when it moves the other way, so that the sand is continually advanced. It comes down to the machines in chutes carrying at their ends valves. The castings are shaken out on a grated floor, below which is a space to receive the sand, which is thence carried up to the sand conveyors again. New sand is added from time to time, the losses being sufficient to keep up the quality.

At East Pittsburg the foundrymen had an opportunity to see the casting of a 13-ton bed plate for an engine, which work was accomplished with very little ceremony. The foundry work here is of a decidedly different nature from that at Wilmerding, as on account of the variety of the patterns it is impossible to do any machine molding.

In the evening a very pleasant reception was held at the Hotel Schenley, which was attended by most of the visiting foundrymen, and by many others, the attendance probably reaching 400. A very fine musical program was rendered, and refreshments were served.

THURSDAY, MAY 18.

The last of the regular sessions of the convention was held Thursday morning. The papers read were:

"The Utility of Chemically Standardized Iron Samples," by Albert W. Smith, of Case School of Applied Science, Cleveland. "The Advantage of an Upper Floor Foundry for Light Castings." by C. J. Wolff, Chicago; "An Improved Method for Seting Up Brass Furnaces," by Eli Millett, of Springfield, Mass.; and "The Deceptive Fracture of Pig Iron," by Thomas D. West.

In the discussion on Mr. West's paper emphasis was laid on the statements that iron of identical analysis must have the same heat treatment in order to produce similar results. There was at first much misleading information, Mr. West said, and recently a paper was prepared which attempted to show by the depth of the chill the constitution of the iron, but more lately it has been found that the depth of chill is greatly affected by the temperature in pouring. Mr. Paul Kreuzpointner, of Altoona, Pa., commented upon the improvement that has been made in intelligently judging and using iron in the foundry. F. W. Bauer, here remarked that the particular value of the standardized samples would be in the smaller foundries. These cannot afford to pay the salary of a high priced technical graduate, who would be a standard in himself, and require therefore a man who will be to a certain extent a practical man, busying himself about many things in the foundry, and for such a man, having only a general knowledge of chemical operations, the standardized samples would be almost invaluable.

New Officers.

The committee on nomination of officers, consisting of W. A. Jones, Chicago; Dr. R. G. G. Moldenke, Pittsburg; Bartlett M. Shaw, Boston; James S. Stirling, Wilmington, Del.; J. P. Golden, Columbus, Ga., made its report, recommending the following, who were elected unanimously:

President, J. S. Seaman, Seaman-Sleeth Co., Pittsburg.
Secretary, John A. Penton, *The Foundry*, Detroit.
Treasurer, Howard Evans, J. W. Paxson Co., Philadelphia.
Vice-presidents: New England States.—A. W. Walker, Walker & Pratt Mfg. Co., Boston. Middle States.—Dr. Richard Moldenke, McConway & Torley Co., Pittsburg. Southern States.—J. P. Golden, Golden's Foundry & Machine Co., Columbus, Ga. Central Western States.—C. A. Bauer, Warde, Bushnell & Glessner, Springfield O. Northwestern States.—W. A. Jones, W. A. Jones Foundry & Machine Co., Chicago. Southwestern States.—W. S. Mosher, Mosher Mfg. Co.," Dallas, Tex. Pacific States.—R. Chartrey, Joshua Hendy Machine Works, San Francisco, Cal. Canada.—Joseph Best, Warden, King & Son, Montreal, P. Q.

Immediately following the election Mr. Bell called President-elect Seaman to the chair. Mr. Seaman on taking the chair said he had some hesitancy in the matter, because the American Foundrymen's Association was an educational affair, and there was considerable labor involved in conducting its business. He was not a general foundryman but a specialist. He said that while the present convention was a very large one, and the Pittsburg foundrymen were proud of the number attending, future conventions would be still larger and more important. He mentioned a case he had had, where the mold opened and let the metal run out because there was a weak clamp which had broken: and said the present emergency in which he found himself was a comparable instance, for which reason he asked the assistance of the members of the association at all times.

Dr. Moldenke here made a motion, which was unanimously carried, that the retiring president, Mr. Bell, be made an honorary member of the association. The motion was amended to include the thanks of the body for the able service rendered during the past year, and during the life time of the association.

Secretary Penton stated in connection with his re-election that his acceptance of the position was contingent on the attitude of the officers of the National Founders' Association, of which he is also secretary. He was willing to serve for the time being, with the understanding that he could resign later, the decision of the matter depending upon a telegram he was expecting from an officer of the other association. With resolutions of thanks to the officers, and to the Pittsburg foundrymen for their magnificent entertainment the convention adjourned.

Received from the Trade.

The Bourne-Fuller Co., Cleveland, has recently sent to its customers celluloid pocket match boxes, top and bottom of nickel, bearing the company's name and lines of trade—iron, steel and pig iron. In the introduction to its May stock list the company makes a suggestion in line with the developments of the past few weeks—that customers will save money and inconvenience by specifying early for any iron and steel they will require in the next few months.

Merchant & Co., Inc., of Philadelphia, with New York, Brooklyn and Chicago branches, have recently prepared and are sending out three treatises on tin roofing, which will interest architects, engineers, and every one using this material. The first explains "How Roofing Tin is Made." The second tells "How a Tin Roof Should be Laid and Painted." The third shows in detail the difference between the Merchant method of manufacturing plates and the old Welsh method, and the reasons for claiming superiority for the former. These pamphlets will be sent to anyone sufficiently interested in the matter to address a request on a postal card to Merchant & Co., at any of their offices.

Oglebay, Norton & Co.'s iron ore hand-book for 1899 contains analyses of a large and varied list of Lake Superior ores, in addition to the Cuban ores of the Spanish-American Iron Co. There are included Ashland, Aurora, Montreal, Lawrence, Globe, Buckeye, Iron Belt and Rand ores on the Gogebic range; Aragon, Granada, Clifford, Keel Ridge, Nimick, Badger, Davidson, L rida, and Bristol ores on the Menominee range; and Adams, Hibbing, Hartley, Pillsbury, Sellers, Linwood, Duluth, Ainslie and Helmer ores on the Mesabi range. In addition to the analyses of these ores the book contains analyses of all Lake Superior ores shipped in 1898, and a statement of shipments from Lake Superior mines from the beginning.

The pipe foundry of the Superior Iron & Steel Works, at West Superior, Wis., started up last week.

THE UTILITY OF CHEMICALLY STANDARDIZED IRON SAMPLES.*

BY ALBERT W. SMITH.

I believe the foundrymen are the latest among the few American manufacturers who begin to realize the manifest advantages of a chemical control over their processes, and hence are becoming interested in those things which tend to make chemical analyses of iron and iron product more accurate and available. Furthermore, grading iron by its chemical composition must eventually take the place of the old methods of grading by fracture, a method devised as long ago as the starting time of pig iron itself, and having long since outlived its proper day of guesswork and chance.

In taking up any new process of manufacture, difficulties are always to be encountered before success and smooth sailing are achieved. Even in applying new modifications to old methods, the same holds true, and often long discouragement attends the introduction of those changes which we are sure are to be eventually valuable, when sufficiently elaborated and understood.

For these reasons, the application of a knowledge of chemistry to foundry practice does not always start with the most complete success desirable, and I presume those of you who have attempted to regulate your iron mixures by a knowledge of the chemical composition of the various irons to be mixed, have already passed through just such discouraging experiences, or are now occupied in overcoming them. The use of the chemical composition of pig iron as a basis for proper blending to produce any desired quality of casting, while the only accurate and scientific method, is beset at the start with grave difficulties, so serious, in fact, that to many I imagine they have appeared insurmountable.

The first theory governing such application was that a given chemical composition always produced the same quality of iron. As a matter of fact, iron and the elements with which it is associated in pig metal, form many differing molecular compounds, so that ultimate chemical composition does not afford all the information necessary for our purpose. Carbon and iron possess the property in common with many other carbon compounds, of forming a variety of substances possessing very different properties and still containing identical proportions of carbon. It was early learned that two irons may have identical ultimate chemical composition, and still have the widest differing physical properties. Something more must be known than the chemical composition of the various grades of iron available, in order successfully to make any desired casting from them. The main circumstance that influences the manner of combination of these elements to form the various compounds possible is the character of their physical treatment, and especially their heat treatment. The soft gray iron may have just the same proportion of carbon as the hardest chilled white iron, so that we must amend our theory somewhat to this form: "*Samples of iron having identical chemical composition and physical treatment, will possess identical physical properties.*" In this form I believe all experience has shown the proposition to be absolutely correct and a safe guide in practice; but in its application numerous pitfalls must be avoided. Perhaps the difficulites most commonly encountered are two: First, that the analysis sent by the iron manufacturer does not represent the average composition of the shipment, due to improper or careless sampling or loading, or that the analysis, made from a proper sample, was incorrect. Second, that the iron, in passing through the foundry cupola, undergoes a chemical change, losing silicon, and possibly gaining or losing other elements.

The latter of these causes of failure in the application of our theory depends for its removal wholly with the founder and his chemist. In almost all cases where iron is melted some change in chemical composition occurs, and the amount and kind of this change varies with the conditions of melting. The first requisite to success in applying the theory to foundry practice, then, is to study the nature and amount of those chemical changes which take place under the various conditions of smelting employed in the foundry under consideration. When these changes are once understood and their approximate quantity determined, allowance may be made for them in calculating the mixture to be employed.

The first cause mentioned, that of inaccurate knowledge of chemical composition, needs for its complete removal the employment by the founders of competent and properly trained chemical assistance. So long as entire dependency for a knowledge of the chemical composition of his stock is placed on the iron producer, trouble is always likely to occur. Not that iron-makers would willfully send out erroneous analyses, but where there is no checking process on either loading, sampling or analysis, carelessness in one or more of these is likely to follow. No matter how well-intentioned the furnaceman may be, if it is known that his customer keeps no control over what he buys, carelessness in loading a shipment, in sampling or analysis is apt to creep in, because employes entrusted with these details are often not so interested in accuracy as they should be, and soon learn where they can be careless without detection. On the other hand, if it is known that every shipment, upon its arrival at the foundry, will be properly sampled and analyzed by a man whose results are most liable to be correct, the material as it arrives at the foundry will seldom be other than as contracted for. In the case of small foundries, where the expense of a chemist's salary could not be afforded, combination could be resorted to in this one item.

As in other commodities, there are different grades of chemists. How is the selection of the right quality to be made? Here, as elsewhere, price is some indication of quality; and I know of no place where low price will be more conducive to ultimate high cost. In general, chemists available for iron laboratories may be divided into two classes—those who have had a scientific, technical training and understand the principles and theory underlying their chemical practice and those who were trained solely as to their fingers and make their analyses wholly mechanically. Of course the two classes grade into each other, and, while an occasional technical graduate degenerates to mediocrity or settles permanently into the common rut of cheap machine-like daily routine, often an exceptionally energetic and intelligent non-graduate will succeed in training himself, by reading and home study, so as to rise to the top level of usefulness. We are all familiar with brilliant examples from these exceptions to the general law. But the safer person to choose as the head of the foundry or furnace laboratory will be the technical graduate, and that one of these who has the self-respect to demand a proper salary. Having now secured proper chemical assistance, what duties are we to allot to him? If he is really well-trained, his sphere of usefulness should be a large and important one. The duties of the furnace and foundry chemist are too often limited to routine analyses of furnace materials and products, and thus he is given no opportunity to render available his scientific training, aside from his ability to make a certain number of analyses daily. Even in the decision as to what analyses shall be made, his judgment is not consulted, and, in fact, this decision is often made by the business manager, whose knowledge of the relative value of the different analyses is usually a limited one. American iron and steel manufacture, and especially American blast furnace practice is characterized by large output and low fuel consumption. Tonnage is the watchword and keynote of success. This requires low labor cost, and the application of numerous labor-saving machines and a highly specialized system throughout. Everything connected with the establishment is made to do its utmost work possible in a given space of time. The chemist has not wholly escaped this spirit of superlative work pressure. He must get out his analyses quicker and make more of them. The first result has been accomplished by devising new and rapid methods of analysis, which are a credit to the ingenuity and patient research of many workers in this field, but mainly of our own American graduates. The second result has been attained in some cases by working longer hours, but in some establishments, I am forced to confess, by half doing the analyses.

At some works the practice exists of keeping record of the total expense of maintaining the laboratory, and this sum total is divided by the whole number of analyses made during this time, the quotient, or cost per determination, being apparently taken as an index of the efficiency of the laboratory! An equally sensible analogy would be to value the services of

* Read at the Pittsburg meeting (May, 1899) of the American Foundrymens' Association.

our physician by the average cost per pill administered, regardless of results. I am informed that in some cases this efficiency index has been squeezed down as low as 15 cents. A chemist in such employ, recognizing the fact that he must keep this cost per determination low to please his superiors, exerts himself to the utmost to swell the number of analyses made, and, no doubt, grinds them out as best he can under such influences, but with how much regard for accuracy and real value to practical application? I wish also to say that there are many laboratories which are not influenced by this expensive fallacy, and where accuracy is the first requirement. In all such places the cost per determination may be very high, but the actual value to the company is correspondingly large, and costly controversies over disputed results are rare or unknown. The very fact that results come from certain laboratories stamps them as correct and allows them to pass unchallenged. This is the reputation to be envied and strived for in all chemical work.

We are all familiar with the trouble caused by poor chemical work. An instance may be mentioned of a company which had shipped some 1,500 tons of iron, all reported by the furnace chemist as within the contract specifications. The iron was rejected by the buyer and the furnace chemist's analysis proven much in error, resulting in a loss to the furnace company in freight, demurrage charges and sacrifice in price of nearly $2,000, an amount probably exceeding the cost of maintaining the laboratory a whole year. We will not even mention the loss in reputation which such a blunder entails.

Another factor tending to produce unsatisfactory conditions in furnace laboratories is the low price paid responsible employes in the laboratory. At many furnaces the wages paid the chemists are little, if any better than those of the subordinate clerk in the office, or of the stove-tender, or of the hot-blast man, and this notwithstanding the fact that the chemist has, or should have, spent four years in preparation at a scientific or technical school, and is entitled to be placed on a plane with the doctor, lawyer, or any of the learned profession. The result is that properly trained men do not remain in such positions, but use them for a few months only as a sort of experience school, and the places must eventually be filled with the finger-trained assistant boy, or be continually on the change in its occupant. The assistant often manages to keep things going well for a time, as long as materials and chemicals remain uniform, but he has learned his methods only in a mechanical way, and, as every chemist learns sooner or later, there are little irregularities occurring which require some general foundation of chemical knowledge for their removal, and it is here that the untrained man is likely to run his company into trouble, and one such trouble is often more expensive in dollars, not to mention loss in mental worry, than any chemists' salary.

Again, it is not to be implied that none but college graduates will succeed as iron chemists, but the employment in so responsible positions as that of furnace or foundry chemist of men or boys with no scientific education other than what is commonly acquired by a few years' experience as laboratory boy, crusher, weigher, etc., is a questionable economic policy, as results are constantly showing.

The position, then, of chemist in the iron and steel industry should be one of dignity as it already is one of high responsibilities. Further than this, let your chemist be given opportunity to utilize, for the benefit of his employer, his scientific training in other ways than the mere routine of daily analyses. Problems are always arising in every sort of manufacturing plant, for the solution of which such a proper scientific training will be serviceable and often necessary. Let the chemist express an opinion as to what analyses had best be made. Certain ones are necessary. Certain others are useful, but not absolutely necessary, and still others are entirely useless.

These are my observations of errors made by iron manufacturers in the treatment of their chemical assistance, and of the causes of trouble in the utilization of chemical analyses of iron as a means for determining foundry mixtures and a guide in foundry practice, and it is to be hoped that the foundrymen will avoid these mistakes at the start. Having begun in the best way in the treatment of laboratory and chemist, every opportunity to insure accuracy should be utilized, and no chemist's services should be retained who is not entirely sure of all of his results. If rapidity of work and number of determination on the one hand, or accuracy on the other must be sacrificed, retain accuracy.

In the past, one method of ensuring this highest degree of accuracy in the best laboratories has been the practice of sending out occasional samples of various products to independent chemists, in order to obtain a check on analyses. Frequently the expense and bother of this plan, while necessary to the best results, are considerable, and the American Foundrymen's Association is certainly to be congratulated upon having found and successfully put in operation a plan by which their difficulties are overcome, retaining at the same time all the advantages of the old way, and more. The starting of the bureau of national standards for analyzed pig iron by a committee of your association has marked a new era in the accuracy, and hence the general value, of iron analyses. The value of such properly analyzed samples is so apparent to the chemist as to appear self-evident and to need no further discussion. They are invaluable in very many ways. In all volumetric methods, the rapid and commonly employed ones, solutions must be standardized with some substance of accurately known composition. Such solutions are most accurately prepared by using as a standard, material of the same approximate composition and character as that for the analysis of which the solution is to be employed. With this in view, the committee has secured such a variety of kinds of iron for the standard samples as to cover all ordinary needs of foundry or furnace practice.

Even for gravimetric determinations, it is always a satisfaction and a guaranty of accuracy to the chemist to possess material whose composition is accurately known, because by occasionally analyzing this along with the routine work, any harmful impurties of reagents, or other causes of inaccuracy, are at once and most certainly detected. Such samples are also in constant demand for color-carbon comparison standards. The care and patience with which these samples were made at the foundry, and their method of casting to ensure uniformity of composition, were almost sufficient to do away with the need of further care, but even this was not assumed to be enough. The samples were cut to a powder, all sifted thoroughly, then spread out on a large glazed surface and intimately mixed.

In filling the individual bottles, they were all spread out on this same glazed sheet, and from each shovelful taken up a very little was sifted into each bottle. The contents of every single bottle of this, upon proper mixing by the purchaser upon its receipt from the express agent, must be exactly the same as every other bottle in the whole sample made, and all results obtained have shown this end to have been achieved.

English Pig Iron Market Advancing and Excited.

The increasing cost of pig iron is one of the most pressing problems of the moment in the steel industry. The average prices now being paid for pig are quite 10s. per ton above those of this time last year. The market is so excited and uncertain that it is impossible to say what trend prices may take during the next month or two. The fact is that both consumers and dealers have to a considerable extent been caught short, and hence there is more pressure on the market at the moment than is either usual or necessary. The legitimate demand for iron is no doubt large, but this is mainly for home requirements, and the volume of consumption in respect of export trade is less than usual. Producers are not unnaturally looking forward to higher prices, but it is evident that if the prices go much higher they will be likely to bring danger, and probably disaster, to the trade; so that it is to be hoped that the present range of prices will not be materially exceeded. Already, indeed, the situation is fraught with serious difficulty to all consumers of pig iron, and especially to steel manufacturers, who have to pay in the open market 10s. to 12s. per ton more than they did a year ago, not to speak of a rise of 60 to 75 per cent in the cost of fuel, and 20 per cent in the cost of labor.—[London Iron and Coal Trades Review.

C. H. Gove & Co.—This firm produces gray iron castings or the general trade. The specialties are machine castings and railroad and stone quarry work. The plant is located at Lorain, O., and the business has been growing in a very satisfactory way in the past year.

ORIGINAL METHODS FOR HANDLING MATERIALS AT THE WORKS OF THE MICHIGAN STOVE CO.

BY W. J. KEEP.

One of the results of a series of years of business depression is that those in charge of manuacturing will have time to devote close attention to each department and by improved methods of production partially compensate for decreased sales. With the advent of dull times in 1893, the Michigan Stove Co. began to devise new methods for manufacture. Probably the only portion of these improvements that would interest the general founder would be the method of handling material and the management of cupolas. The space available for storage of flasks, coke, iron, and sand is very small, which was for years considered a disadvantage, but under the changed methods it is a positive advantage. Formerly all cupola supplies were wheeled to elevators, and were hoisted to the platforms and unloaded, then when the cupolas were charged the materials were placed on scales and weighed and handled again in charging. While using elevators it was necessary to maintain inclined runways to be used in case of frequent derangement of elevators. It was found that wheelers would stop to rest about so often, and invariably would wait at bottom and top of the elevator for one reason or another, therefore when the elevators wore out they were not replaced, and it was found cheaper to use the inclined ways exclusively.

All the melted iron is taken in hand-ladles holding 50 pounds, therefore there is no use for appliances for carrying melted iron. The railroad track on which all supplies are received is located between the iron yard and the foundry, making it necessary for all materials to cross the railroad track in going to the cupolas. In common with other foundries it had been impossible to have melters charge materials as they reported them causing each year a great shortage in both coke and iron when the amount purchased was taken into account, and it was a common experience to show more castings produced than pig iron melted. Flasks had always been exposed to the weather, and could only be found by men who were familiar with their location, and who spent more time searching for flasks than in their transportation when found. The carpenter shop was located a long distance from the flask yard, requiring that flasks should be wheeled to the shop, and when ready to use should be again wheeled to the foundry.

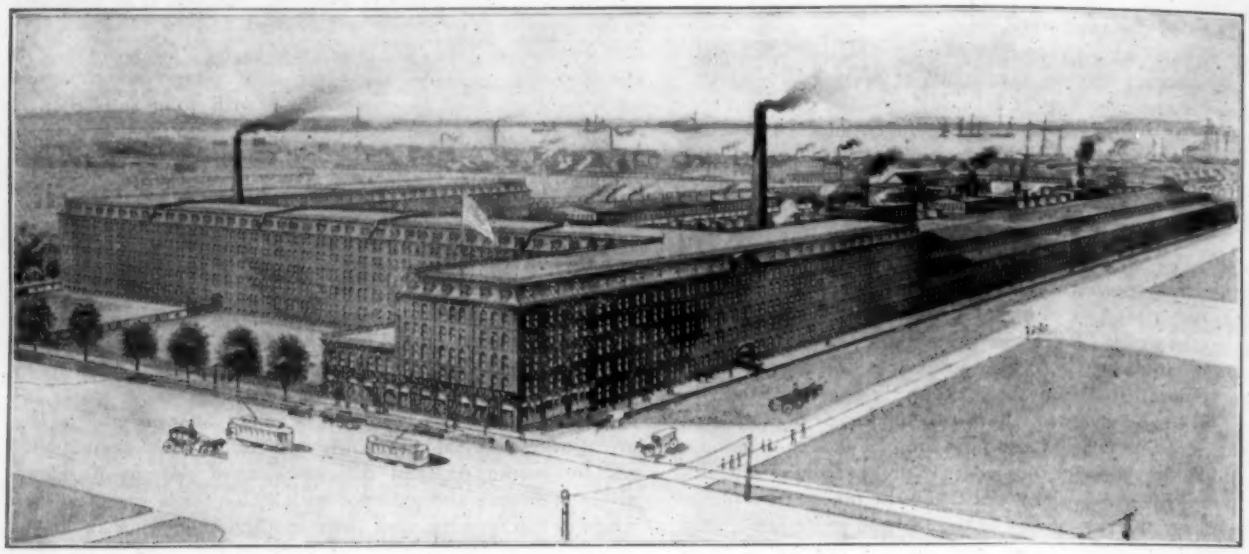

FIG. 1.—WORKS OF THE MICHIGAN STOVE CO.

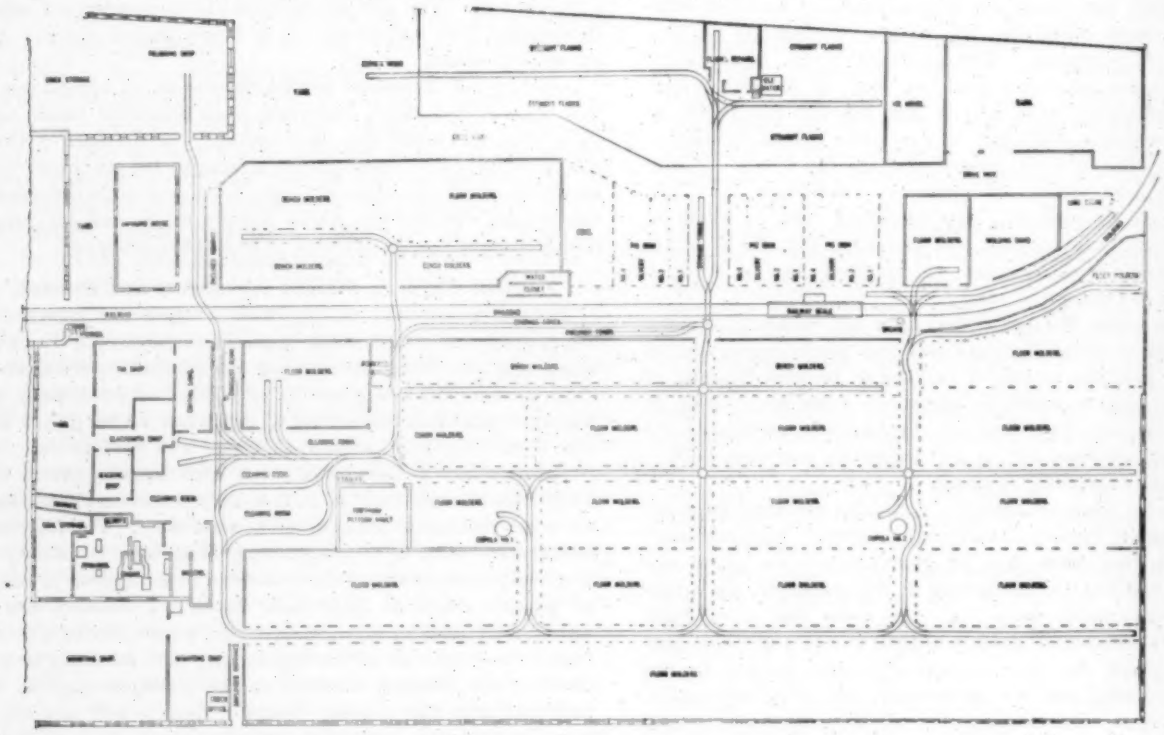

FIG. 2.—PLAN OF INDUSTRIAL RAILWAY ON GROUND FLOOR OF FOUNDRY.

The subject of improvement in methods was under consideration for several years. At one time it seemed possible to adopt a trolley system, but difficulties appeared that finally lead to the adoption of ground tracks with 20½-inch gauge, and curves with a 12 foot radius, and as few turntables as pos-

*Read at the Pittsburg meeting (May, 1899) of the American Foundrymen's Association.

sible, requiring cars with flexible wheel base. The traveling crane was erected to reach every part of the yard. With it all materials for cupolas were hoisted to a weigh house on the foundry roof and were then sent to the cupolas on a gravity road. A two-story building was erected to hold all flasks, and the carpenter shop was located in its center, with an elevator reaching the roof and each floor. Electricity was adopted for motive power. After submitting drawings for the general arrangement to several manufacturers of foundry appliances, it became apparent that many modifications of industrial railroad. Fig. 3 shows all tracks located above ground, and also shows the location of the rails for the crane to travel upon. Flasks from the second story of the flask shed are run on cars to the end of the track, and are taken by the crane to the ground track. On the roof of the sand shed are tracks for dump cars which drop sand or fire clay into the space beneath. On the edge of the foundry roof are tracks for storage that curve into the weigh house. On one of these is stored cars, each of which contain three boxes of coke, and on the other track are stored cars each containing three boxes

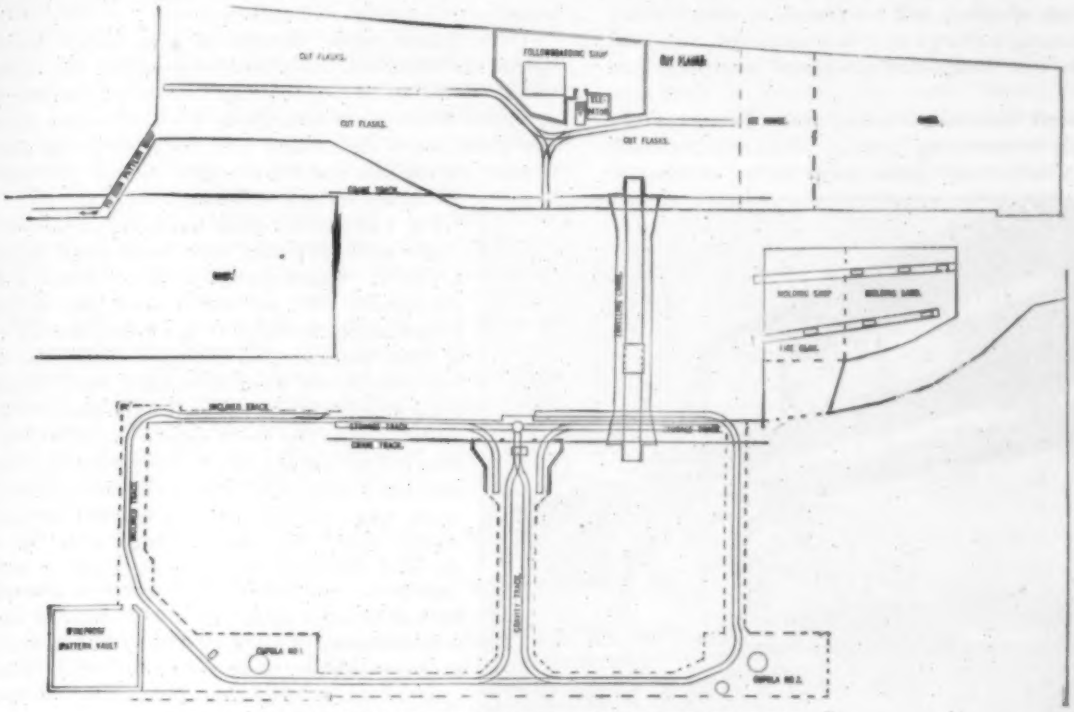

FIG. 3—PLAN OF INDUSTRIAL TRACKS ON SECOND FLOOR.

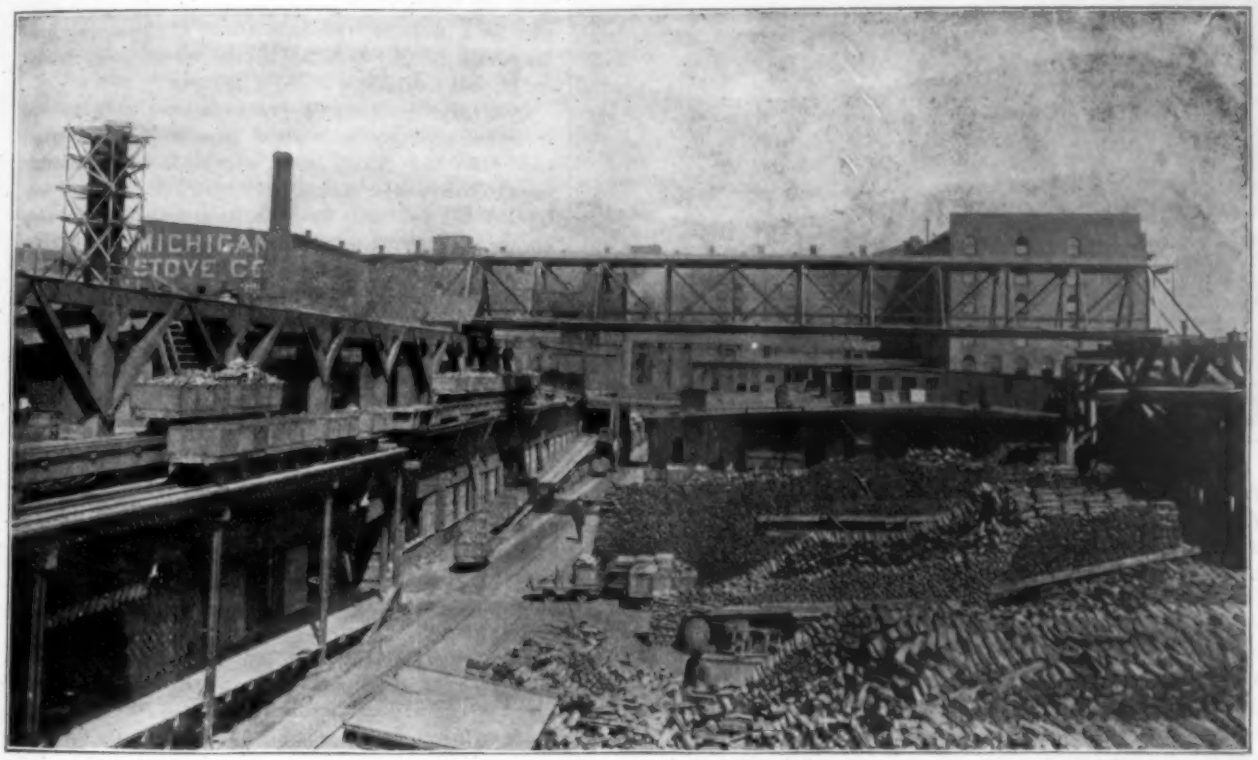

FIG. 4—REAR VIEW OF MICHIGAN STOVE CO.'S WORKS.

would be necessary as the work progressed. Contracts were therefore given for the whole of the work to a Detroit firm, The Russel Wheel & Foundry Co., who had begun the manufacture of industrial railways and cars, and who were willing to design a crane that would suit the requirements.

Fig. 1 is a general front view of the plant of the Michigan Stove Co. Fig. 2 is a ground plan of the foundry and buildings containing industrial railway, and shows curves, turntables, crossings of railroad and location of supplies and flask house. All together, there are over three-quarters of a mile of sprues.

A car with pig iron is lifted from the iron yard to the weigh house, where the exact amount of pig iron is weighed. By a swinging crane and a special lifting device a box of sprues is transferred to one end of the car and the correct weight put on, then a box containing the required amount of coke is placed on the other end of the car, the whole being one charge for a cupola. The car is then pushed on one of the gravity roads to one of the cupolas, and so on until the tracks between the scale and cupolas are filled with loaded cars.

When the contents of the cars are charged into the cupola, the cars from. No. 1 cupola, by the use of friction winch are run down the track on the old incline to the yard, but the empty cars from No. 2 cupola are sent by a gravity track to a storage track near the weigh house. The first car each day contains limestone which is dumped on the platform near the cupola and shoveled in with each charge, about 40 pounds being used to each ton of iron. After that car is a car of wood for lighting the fire, then three cars of coke for the bed, after this each car contains 1,300 pounds of pig iron mixed as ordered, 700 pounds of sprues and 230 pounds of coke. When the last car containing a charge of iron is unloaded, cars containing iron from the dump and gangway sweepings are charged.

Fig. 4 is a general rear view, showing in the distance a rope drive 400 feet long transmitting 75 h. p. This was formerly exposed to the weather, but gives much better satisfaction

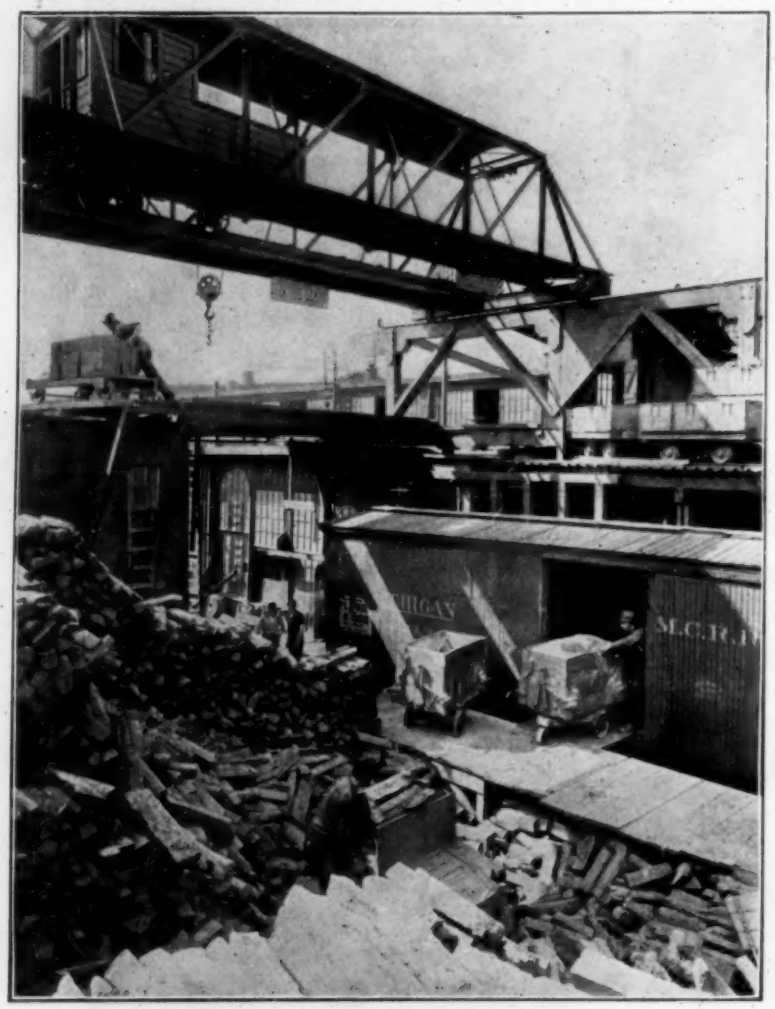

FIG. 5.—UNLOADING MOLDING SAND.

since it is covered by a roof. This figure shows a general view of the crane, which is an ordinary bridge, without a floor, provided with lateral trusses to allow the cab which contains the hoisting machinery to run on the lower chords. The bottom of the cab is of plate glass, enabling the operator to see everything in the yard beneath him. In the cab are three controllers for operating the crane. The motor for moving the bridge is located at one end and the torsion of the shaft allows the other end to lag a little behind. When the crane can be spared the motor will be moved to the center so that the travel of both ends may be the same. The length of the crane is 90 feet from one track to the other. Its capacity is three tons, the length of wheel base is 14 feet, the speed of hoist is 50 feet per minute, of cab 100 feet, and of bridge 130 feet. The motor for hoisting is 6 h. p., that for moving the cab 12 h. p., and for moving the bridge 12 h. p. The trestles for the bridge are pine, those on the foundry end are a part of the frame of the foundry, and on the other side form the frame of the flask house.

Under the left end of the crane in Fig. 4 is the storage track for coke, which curves into the weigh house, and on the left of the weigh house is the storage track for sprues. Just in front of this and a litle below it is the storage track for empty cars, that have been sent out from No. 2 cupola. The crane in returning from a load can take back two empty cars. Beneath this track is the old incline for wheeling to No. 1 cupola, which is now occupied by an inclined track from No. 1 cupola, down which cars are lowered by a friction winch near the cupola. On the ground below this track is a storage track. At right angles to this, between the pig iron piles, and leading from the entrance to the foundry floor, is the track to the flask house, and beside it is a storage track on which is stored cupola cinders and sprues.

[Here follow some details of the weigh house, and operations there, and the method of charging the cupola. It was the intention at first to dump the box of coke and the box of sprues directly into the cupola, but for fear that the materials would not be distributed uniformly the boxes are being dumped on the floor and the contents thrown uniformly over the whole surface with a fork.—Ed.]

Fig. 5 shows the crane unloading a car of sand. There arethree trucks, each having two wheels and a caster. There are three boxes, which will each hold about 1,500 pounds of sand, and which have drop bottoms dumped with a lever. A truck and one of these boxes are run into each end of the car and two men shovel sand into each box. The third truck stands outside the car on the platform and the crane lowers the third empty box on it just as two men roll a filled box out on the platform. They hook onto the full box and the crane lifts it onto the roof track, while the men roll the empty into the car for another load. The box is loaded onto the car, on the roof, which is run by a man to one of the openings in the roof, where the bottom is dropped and the car brought back. To unload a car of sand with wheelbarrows takes three hours for six men, while six men with the crane will unload it in one and a quarter hours. Fire clay is unloaded in the same way, and is dumped into an overhead bin holding two car loads. This bin has in its bottom a hopper with a slide, through which the ground fireclay falls directly into the kettle where it is mixed for cupola daubing.

Iron trays with trips operated by the man in the cab were arranged to unload iron and coke from cars, but the crane is so occupied with hoisting cars to the weigh house that iron and coke is unloaded by contract by wheelbarrow. Fig. 5 also shows a man making up a charge of pig iron, taking the required number of pigs from each pile. On the roof is seen the covered exit from No. 2 cupola with empty cars coming out on to the storage track below the storage track for sprues.

[The remainder of the paper which describes methods in vogue in the foundry will be given next week.—Ed.]

American Steel Taking the World.

In an interview at London last week Andrew Carnegie said: "The supremacy of the United States in the iron and steel trades is permanently established. The United States are barely tapping their resources of iron, coking and coal fields, while England and Germany are working to the full limits of their tether. England's product of pig iron is decreasing year by year, despite the big price it now fetches. England and Germany are working up to their utmost capacity to-day, the cost of raw materials is steadily increasing and it is impossible for them to compete in the open markets of the world at the price the American manufacturers can afford to take for their surplus. Neither has the immense home market of the United States —and the country which furnishes the best home market is the best equipped to capture the foreign."

The Champion Iron Co., of Kenton, O., has secured the contract for a $23,000 job of jail and iron work at Oshkosh, Ind., and another considerable contract at Coldwater, Mich., this being the second of its kind within the past few weeks.

CONSTRUCTION OF BRASS MELTING FURNACES.*

BY E. MILLETT.

Our idea in this paper is not to show how cheap furnaces can be built, nor how many tons of metal can be melted in five minutes. We think that the brass foundry should be as well equipped as the iron foundry. The old cupola, blower and crane have all made way for the modern ones. The same is true of the old fashioned core-ovens; they also had to make way when the now well-known Millett oven put in its appearance, and which is now rapidly replacing the old oven all over the world.

The old brass melting furnaces, with their brick piers, which are always tumbling down, are being replaced by the furnaces herein illustrated, for which letters patent have been granted to Messrs. E. P. Marsh and E. Millett, of Springfield, Mass.

The construction embodies several furnaces arranged on opposite sides of a main flue running longitudinally between them. These furnaces are supported upon a substructure or base, which is practically indestructible, for it consists of masonry and wrought iron I beams, running lengthwise and crosswise within and on the base. The main furnace flue, which connects the chimney, runs along over the top of the base between the lines of furnaces, and a suitable flue connects each furnace with the main flue. The top set of I beams, running crosswise on the base, project out beyond the sides of said base. Resting on these beams are the furnaces, which are bolted through the top and bottom plates to the beams. Therefore, no use that the furnaces themselves may be subjected to can vary the proper condition of the base, as to supporting the furnaces perfectly in place.

The furnaces are also united by connecting straps, front and back. Each furnace is provided with a grate, hung and supported in the usual way. The pits are covered with iron grating, and this, with the absence of brick piers, assures an equal distribution of draught. It also enables the melter to instantly detect any leakage of metal from the pots.

The main flue is carried up somewhat above the top of the furnaces, and is well covered with iron plates and masonry. On this is placed a cast iron box opposite each furnace for holding metal to be used in the furnace. This last arrangement provides for the laying of the metal into proper charges for each crucible, and placing them in each box. By doing this greater care can be exercised in the mixing of metal for each crucible than is possible when the metals are strewn around the floor of the foundry, as is generally done. The provision of a comparatively large main flue, which answers for all the furnaces, and which gives a comparatively uniform draught, insures a uniform speed, so to speak, for melting the metal in all the pots.

A plant, comprising 18 furnaces, arranged on the above plan, has been in constant use in the foundry of the E. Stebbins Mfg. Co., Springfield, Mass., for about a year, and it has there been proven that the melting of metals is much greater and thereby more economical by this construction of furnaces than by furnaces ordinarily used.

Empire Steel & Iron Co.

The following officers have been elected of the Empire Steel & Iron Co., organized recently under the laws of New Jersey, with an authorized capital of $5,000,000, half of which is 6 per cent preferred stock; president, L. Peckitt, Catasauqua, Pa.; vice-president, Walter Kennedy, Pittsburg; general manager, W. L. Sims, New York; secretary, Glen Wright, New York; executive committee, Archer Brown, E. R. Chapman and W. L. Sims. The board of directors consists of the above and W. E. Scarritt, E. K. Summerwell, and F. M. Jeffrey. The company has acquired by purchase the property of the Greensboro Furnace Co., Greensboro, N C.; the property known as the Henry Clay Furnaces, of Reading, Pa.; the Topton Furnace, in the Schuylkill Valley; the Victoria Furnace on the Chesapeake & Ohio Railroad, in Virginia, and the Huddleston ore property, in the Potts Valley, Virginia. It has acquired by lease the Valentine Furnace property at Bellefonte, Pa., and has four-fifths ownership of the stock and second mortgage bonds of the Crane Iron Work , of Catasauqua.

* Read at the Pittsburg meeting, (May, 1899) of the American Foundrymen's Association.

INDUSTRIAL SUMMARY.

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New Buyers in the Market, and Some of Their Wants:—

At Chester, Pa., the Solid Steel Casting Co. is being formed to take the Eureka Steel Works and operate them on a larger scale. The incorporators are officers of the Pennsylvania Steel Co. and the Maryland Steel Co. The Maryland Steel Co. will use the product largely in its work.

The Peru Steel Casting Co., Peru, Ind., has been incorporated by Geo. A. Swartout, Wm. J. Cooke and Chas. L. Sullivan.

The Walter Steele Malleable Iron & Steel Co. has been organized at Reading, Pa., with Walter Steele as general manager. The president is Cornelius V. Seidel, of New York, and J. F. Whipple, of New York, is secretary and treasurer. The plant of the old Keystone Wagon Works has been leased. It is proposed to manufacture crucible steel.

New Construction:—

The C., St. P. M. & O. Railway Co. will build a machine shop at St. Paul, to cost $24,000.

Coshocton, O., citizens are organizing a company to be known as the Coshocton Iron & Steel Co., capital stock $100,000. It is reported that a tin plate plant is contemplated, and the name of Ambrose Baird is mentioned in connection with it.

A Birmingham special says that the Wilson Mfg. Co., of Chicago, will remove to Birmingham and has selected a site for manufacturing engines.

The Diamond State Steel Co., $3,000,000 capital, which absorbed the Diamond State Iron Co., Wilmington, Del., expects to erect additional plant on the 85 acres of land recently bought. The officers are: President, Howard T. Wallace; treasurer, W. H. Jenks, Jr., of Philadelphia; secretary, W. H. Wallace.

The Pullman Palace Car Co. has taken permits at St. Louis to erect repair and other buildings, costing $27,800, to replace those burned a few years ago.

The purchases of the National Steel Co. adjoining its Mingo Junction, O., property are reported to take in 110 acres of land. The plans of the company are for two 500-ton furnaces and for additional steel works and bar mill capacity.

The Royersford Foundry & Machine Co., Royersford, Pa., will begin in a short time to build its new plant on the ground of the Alpha Paint Co., recently purchased. Several of the contracts have been given out

The Midvale Steel Co., Nicetown, Pa., contemplates erecting two additional buildings, one an open hearth steel plant, and the other a forge plant to cost $1,000,000.

Fires and Accidents:—

The foundry of Sibley & Ware at South Bend, Ind., was damaged $4,000 by fire last week.

The Biggs Boiler Co 's plant at Akron, O., was partly wrecked by wind, May 16.

At Saginaw, Mich., fire in A. F. Bartlett & Co.'s' machine shop caused a loss of $9,000.

The Albany Boiler Works, Albany, N. Y., were destroyed by fire, May 11. Loss $20,000.

The Pittsburg District:—

The old Keystone rolling mill, on Second ave., Pittsburg, was started in operation this week by James McCutcheon, of Lindsay & McCutcheon, acting on his own account. The mill is owned by the estate of the late Mr. McCutcheon.

Jones & Laughlins, Ltd., will start some time this week, the old Moorhead-McCleane plant, which they purchased recently.

The new spike plant of S. Severance, Pittsburg, will be erected at Glassport, Pa. Ground is to be broken next week. There will be 25 spike machines. The plant will embrace several buildings, and will cost in the neighborhood of $100,000.

T. B. Mellon, of A. Mellon & Sons, bankers, Pittsburg, succeeds the late Capt. A. E. Hunt as president of the Pittsburg Reduction Co. The company is starting the erection of a plant at New Kensington, for the reduction of the bauxite to

alumina, from which the electrical process extracts the metal. This work has heretofore been done at the Pennsylvania Salt Mfg. Co 's Works at Natrona, Pa. The company has just completed a large rod mill for rolling wire and cables for electrical purposes From the rods the aluminum is rolled down into one-eighth-inch wire, while sizes smaller than this are drawn. The mill is equipped with a cable machine capable of twisting 49 strands of wire into a cable 1½ inches thick. Another machine is being installed which will make 127 strands into a cable 2 inches thick.

Engineering firms in Pittsburg are figuring on a number of new blast furnaces, which will be modern and will increase materially existing capacity.

Edward E. Erikson, of Pittsburg, has secured the contract for the three 20-ton acid open-hearth furnaces for the new plant of the Pittsburg Steel Foundry Co., at Glassport, Pa.

The Oliver Iron & Steel Co. has introduced more new bolt-threading machines in its South Eleventh st. mill and has advertised for 150 girls to operate them. Several girls have been put to work. The wages are from $4 50 to $7 a week.

The plant of the Garden City Wire & Spring Co., at 51st ave., and the C. M. &St. P. Ry. tracks, Chicago, was destroyed by fire last week, with a loss of over $25,000. The plant occupied a ground space of 160x55 feet and was two stories high. The company manufactured metal beds and wire springs, mattresses and wire goods of various kinds.

Bement, Miles & Co., through their Chicago office. Paul S. Pettelle, manager, have had a very good trade recently, especially in heavy steam hammers. Among recent orders were the following: Three hammers to the Atchison, Topeka & Santa Fe road, and a 2,000 lb. hammer to A. Finkl & Son, of Chicago, together with several other orders, large and small. The Chicago office of the firm is at 1534 Marquette Building.

The J. A. Sundberg Co., Chicago, capital stock $30,000, has been incorporated for blacksmithing, forging, and manufacturing, by J A. Sundberg, C. A. Rice and Gustav Sundberg.

The Pressed Steel Car Co. announces that the Fox plant at Joliet, Ill., will be enlarged to four times its present capacity. A tract of 40 acres has been purchased, and the changes will cost $500,000.

The Garden City Sand Co., Security Bldg., Chicago report unprecedented demand for their Franklin Crown fire brick. Not only does the demand extend all over the United States, but they have recently made shipments to Russia, various points of Mexico, and to the West Indies.

General Industrial Notes :—

The Burgess Steel & Iron Works, Portsmouth, O., have made a 15 per cent increase in wages.

The Sloss Iron & Steel Co., Birmingham, Ala., started a fourth furnace on May 17, adding 175 to 200 tons a day to its capacity.

At Kenosha, Wis., the Northwestern Wire Mattress Co., Z. G. Simmons, manager, has increased wages 10 per cent.

The Hartford Machine Screw Co., of Hartford, Conn., and the Western Automatic Screw Co., of Elyria, O., are reported to have given options to the promoters of the screw consolidation Options run to June 10. It is proposed to take in seven other screw companies.

The Michigan Iron & Steel Co., Muskegon, Mich., has increased its capital to $500,000. E. W. Gillet, of Chicago, is reported to be the leading holder.

A majority of the stock of the Ohio Iron Co., Janesville, O., has been bought by the National Steel Co. The blast furnace will be kept in operation and it was its need of pig iron that led the National company to make the purchase. It is possible that the rolling mill will also be started, but this is not certain.

The plant of the Joliet Wire Co., at Rockdale, near Joliet, Ill., has started up. Two machines are in operation. E. G. Minnemeyer is manager.

Mining of iron ore will be resumed by the E. & G. Brooke Iron Co., at French Creek, Chester Co., Pa. The mines have been idle for 10 years.

The Pneumatic Supply & Equipment Co. has been organized under the laws of the State of New York and has opened an office at 120 Liberty st., New York. It is the purpose of the company to deal generally in compressed air equipment and it will make a specialty of the installation of complete plants, eliminating the division of responsibiltiy which has heretofore existed in the trade. The company is bringing out several specialties in the compressed air line, such as pneumatic oil rivet forges, quick acting hose couplings, and has in addition closed agencies for several standard types of compressors. J. W. Duntley, president of the Chicago Pneumatic Tool Co., is president of the new company. E. B. Gallaher, formerly with Patterson, Gottfried & Hunter, is vice-president and engineer, and W. P. Pressinger, formerly of the Clayton Air Compressor Works, is secretary and treasurer.

The Republic Iron & Steel Co. is expected to increase the steel-making capacity of the Birmingham Rolling Mill to a daily output of 300 to 400 tons, and erect another furnace on its Pioneer properties.

Notices were posted lat week at the South Chicago, Joliet and Bay View plants of the Illinois Steel Co., announcing an increase in wages. Common labor was raised from 13½ to 15 cents an hour, and all other hands except the tonnage men, inproportion. The increase, the second within the year, went into effect May 15.

It is reported that the National Steel Co. is negoitating for the purchase of ground at Sharon, Pa., for extensions to the Buhl open-heart steel plant.

The employes of the blast furnaces of E. & G. Brooke Iron Co., Birdsboro, received another advance of 10 per cent in wages, taking effect on May 15. They are now getting 24 per cent over 1898. At the puddle mill during the month of April the advances amounted to 33⅓ per cent.

It is expected that Helen Furnace at Clarksville, Tenn., will be started early in June.

The Penn Iron & Coal Co. has decided to add another stove to its blast furnace at Canal Dover, O., and has placed the contract with David Lamond, contractor and engineer, Ferguson Building, Pittsburg, Pa. It will be of the C. H. Foote two pass type of fire brick stove, 17x75 feet. A new blowing engine is also being built.

At the blast furnace and steel works of the Wheeling Steel & Iron Co., Wheeling, W. Va., a wage advance of 10 per cent has been granted, bringing wages to the basis of 1892.

The Electric Vehicle Co., has bought the entire capital stock of the Siemens-Halske Electric Co. of America. This means that the big plant of the Siemens-Halske Co. in Cicero, Ill., will be used for manufacturing the motors and like appliances for the electric cabs and auto-trucks, for Chicago and for the Western field generally. Practically all the stock of the Siemens-Halske Co. was owned by the Pennsylvania Iron Works. The latter have not yet been formally acquired by the electric vehicle interests. Probably the relations between the Pennsylvania Iron Works and the electric vehicle concern will become more intimate. The Electric Vehicle Co., which acquires the capital stock of the Siemens-Halske Co., is the parent concern, and it will do the manufacturing. With it are affiliated the Electric Storage Battery Co., of Philadelphia, and the Pope Bicycle Works. There has also been organized the Illinois Vehicle & Transportation Co., with a capital of $25,000,000, which will operate electric vehicles in Chicago and Illinois.

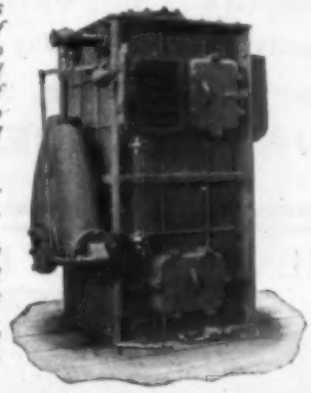
The Harrison Safety Boiler Works, of Philadelphia, have made sales of Cochrane separators recently as follows: Wadsworth, O., Salt Co., two 3-inch; G. N. Parks, Fitchburg, Mass., one 4-inch and one 6-inch; Peoria & Pekin Terminal Ry. Co., two 7-inch; Coplay Cement Co., two 14-inch; Edison Elec. Ill. Co., of Boston, two 9-inch receiver separators; Iowa City Elec Lt. Co., 7-inch; Lorain Steel Co., 6-inch receiver; American Tobacco Co., St. Louis, Mo., one 3½-inch and one 4-inch; National Enameling & Stamping Co., one 12-inch, and two 10-inch; General Elec. Co., Schenectady, N. Y., one 7-inch; Parke & Lacy Co., San Francisco, one 3-inch; J. C. Hubinger, Kookuk, Ia., one 4½-inch, two 6-inch; Gloucestor, N. J., Mfg. Co., one 8-inch receiver; Wharton Blast Furnaces, one 9-inch and two 3-inch; American Blower Co., London, England, one 6-inch; Smith & Davis Mfg. Co., St. Louis, one 6-inch; Buckeye Engine Co., two 4½ inch; Midvale Steel Co., one 4-inch one 4½-inch, one 5-inch, and one 6-inch; The Gladstone, Philadelphia, two 4-inch, one 12-inch; Middletown Paper Co., one 5-inch; Everett Piano Co., Boston, one 7-inch; Roxborough, Chest-

COCHRANE HEATERS SAVE IT.

What would you think of a man (the owner of a 100 h. p. steam plant, for instance) who would deliberately throw away 5,000 pounds of perfectly pure, distilled water every ten hours, and use instead that much cold water containing all the impurities that make scale in boilers, such as mud, sulphates, and carbonates of lime and magnesia, chlorides, etc.?

Thousands of people are doing this very thing,—hundreds of plants of 1,000 h. p. are throwing away 50,000 pounds of pure water every day, and paying for taking the scale out of their boilers—paying for extra coal to get steam from those dirty boilers, and paying for repairs of all sorts.

The chances are you are doing the same thing. Every closed or pressure heater wastes this pure water, unless ahead of it in the exhaust main is placed an independent oil separator and trap, and some means is adopted for conveying this condensation into the boilers, or to the point where the boiler feed pump draws its supply.



If you used a **COCHRANE HEATER** *all of this condensation would find its way into your boilers in a pure state, without using the separate appliances referred to above.*

We can equip you either with an independent oil separator that will positively remove all of the cylinder oil, or, better still, we can furnish you with **COCHRANE HEATERS.**

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MFRS. COCHRANE SEPARATORS.

nut Hill & Horristown, Ry., one 12-inch, etc. Also separators for U. S. Steamships, "Isla de Lousen," "Don Juan de Austria," "Isla de Cuba."

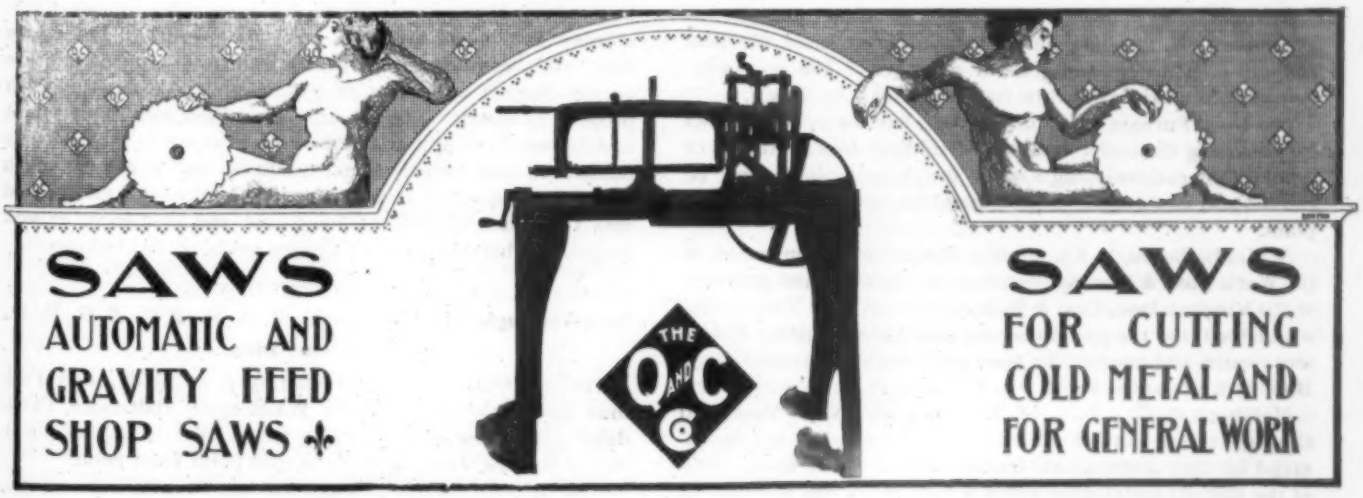
The Chicago Pneumatic Tool Co., has purchased the patents formerly owned by the Consolidated Pneumatic Tool Co., now defunct. These patents include all the Keller and Wolstencroft types of tool construction and in addition several new applications which have not yet been taken out. These patents originally cost the Consolidated Pneumatic Tool Co. about $40,000.

The Roberts type of Cowper fire brick stove is being built at many of the large furnace plants. Among the companies that have adopted it are the Ohio Steel Co., Youngstown, O.; Lorain Steel Co., Lorain, O.; and Laughlin & Co., Pittsburg. This stove is patented by Frank C. Roberts, of the firm of Frank C. Roberts & Co., engineers, Philadelphia.

Preliminary to its sale by the receiver of the Republic Iron & Steel Co., the Birmingham Ala., Rolling Mill Co 's assets and liabilities were reported to the court by a referee. The latter was $480,480.70, including $72,300 preferred stock, $335,780.70 bills payble, $20,000 unpaid interest, $43,100 open accounts and $9,300 received indebtedness. The assets, including minimum value of plant, at $275,000, unfinished stock at $190,057, finished stock at $59.000. open accounts of $63,905, bills receivable of $16.417 and cash on hand amounted to $615.408.02. Net surplus by this showing, $134,927.32.

Some recent sales of the Cochrane feed-water heaters and purifiers are reported by the Harrison Safety Boiler Works, of Philadelphia. as follows: Alcania Tin Plate Co., Avonmore, Pa., 1.250 h. p.; Schoonhofer Brewing Co., Chicago, Ill., 150 h. p.; McCormick Harvesting Machine Co., one 5,000 h. p. and one 2,000 h. p.; Dayton, Xenia & Bellbrook Ry. Co., Dayton, O., 600 h. p.; The Lima Honeoye Elec. Lt. & R. R. Co., Honeoye Falls, N. Y., 350 h. p.; Cambridge, Mass., Jail, 500 h. p special; E. Sutro & Co., Philadelphia, 150 h. p., special; Penna. & New York Canal & R. R. Co., Sayre Pa., 850 h p.; American Cement Co., Coplay, Pa., 150 h. p.; Schwarzenbach, Huber & Co., Altoona, Pa., Silk Mill, 1,000 h. p ; University of Wisconsin, Madison, Wis., 200 h. p.

A Bellefonte, Pa., dispatch says that a deal has been practically closed by which Eastern capitalists will become owners of the Collins furnace, the 150-ton plant built by Collins Brothers in 1887, which has been idle since 1890. The new company will also purchase the ore mines of the Carnegie



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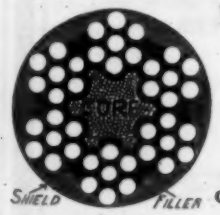

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WRITE FOR NEW CATALOGUE.

Steel Co. at Scotia, as well as the ore rights of a large tract of land. J. W. Gephart, of Bellefonte, negotiated the deal and will be president and general manager of the company. It is the intention to have the furnace in blast by July 1.

The Dora Furnace Co., Pulaski, Va., has awarded contract for enlarging its boiler house and adding four batteries of tubular boilers developing 1,000 h. p. Another stove will be erected and new engine will be installed, making it a 200-ton plant.

At Middlesborough, Ky., formal transfer has been made of the Watts Steel & Iron Syndicate, Ltd., furnaces and property of the Virginia Iron, Coal & Railway Co., of New York. It is understood that the new owner expects soon to make extensive repairs and operate the steel plant to the fullest capacity. Both furnaces are in blast.

Merchant & Co., Inc., of Philadelphia, New York and Chicago, report in their smelting department an active demand for their iridium anti-friction metal. This is an alloy of the Babbitt metal class which is very much like the famous Parson s English mixture which has been used in heavy machinery and steamship work for many years. The above firm, after extensive experiments and tests put this mixture on the market a number of years ago and time has given proof of its merits. It is a coarse grained, very white, light and extremely tough material which is equal to brasses in its endurance and anti-frictional qualities, but it can be much more easily used as it can be melted in the ladle and poured into the boxes instead of being cast and filed to fit, as with brasses. This company sells every grade of Babbitt metal.

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Through train from Cleveland 3:25 p. m., daily, with Pullman buffet sleeping cars to Washington, Baltimore, Philadelphia and New York, carrying Royal Blue dining car Washington to New York, arriving at that point 12:35 noon.

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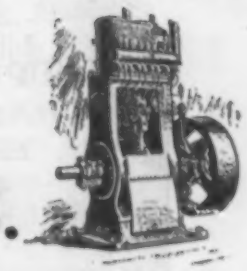

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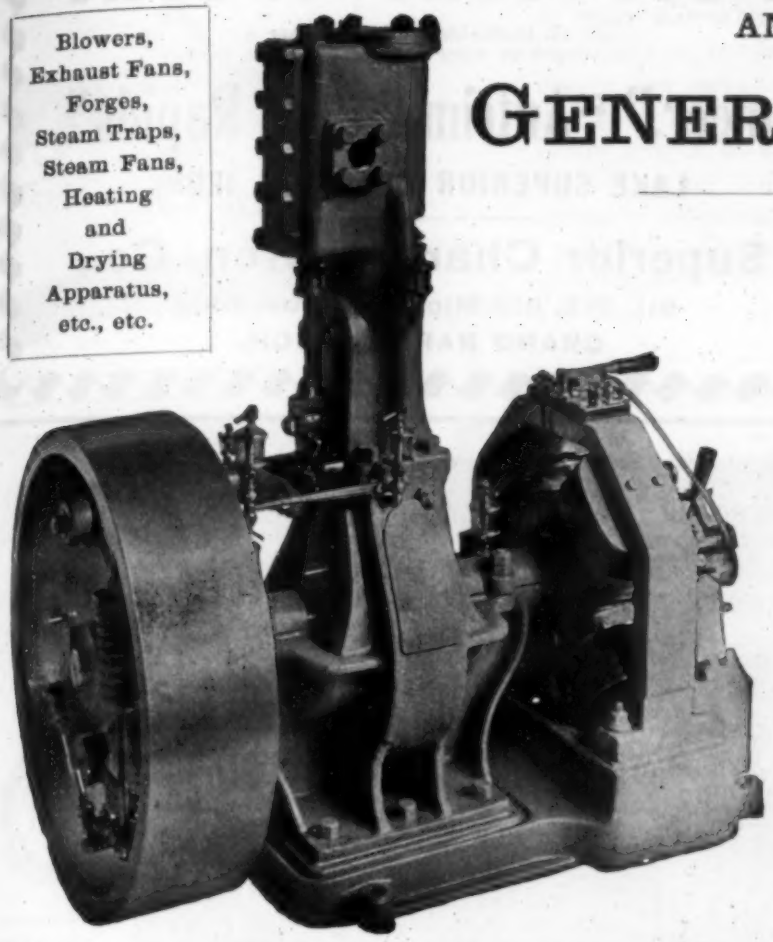

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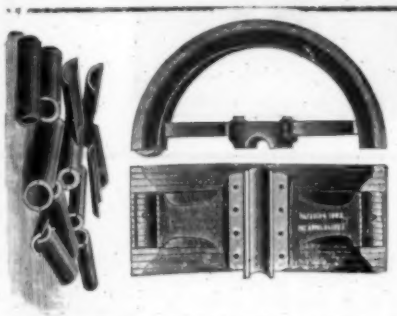

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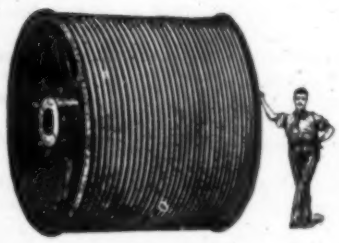

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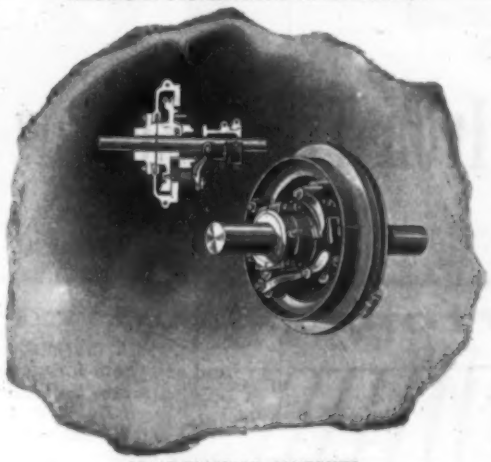

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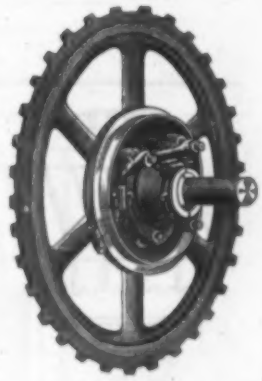

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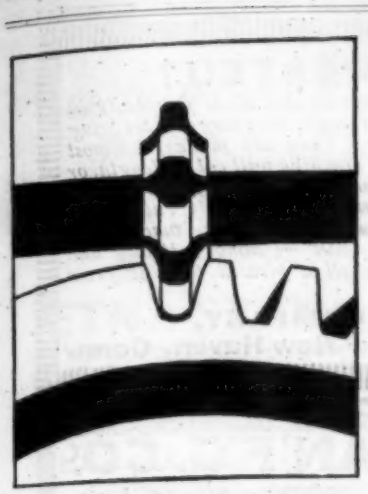

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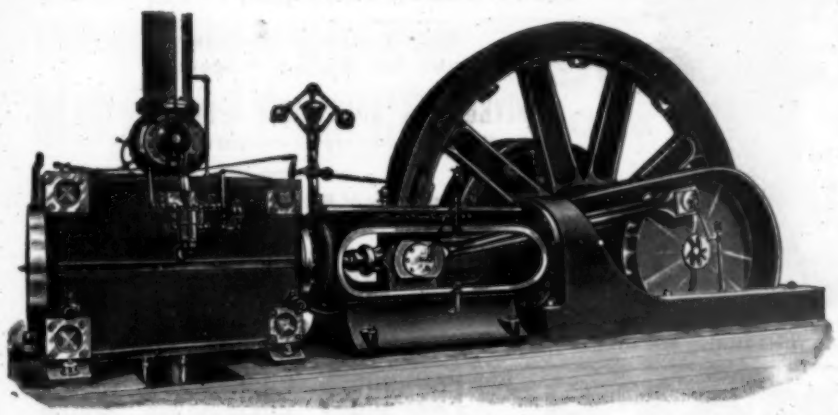

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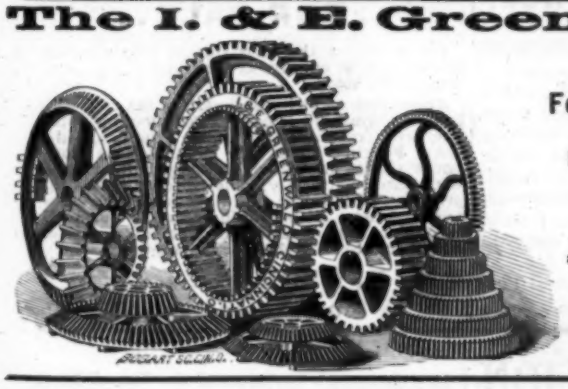

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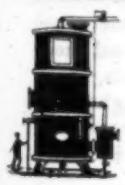

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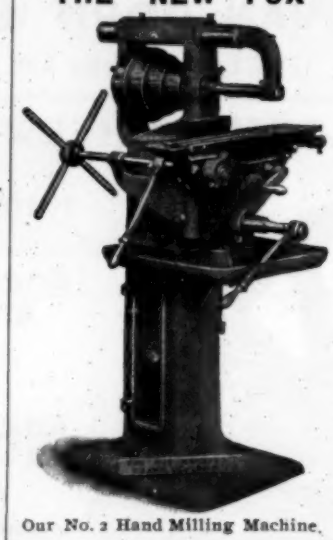

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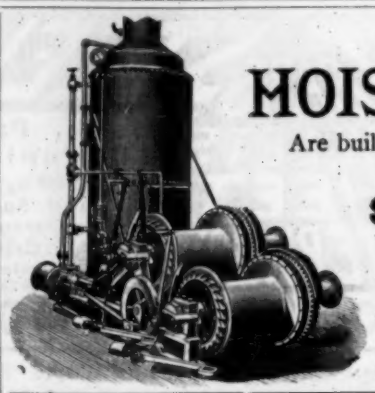

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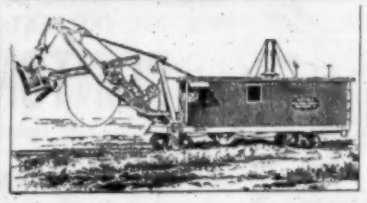

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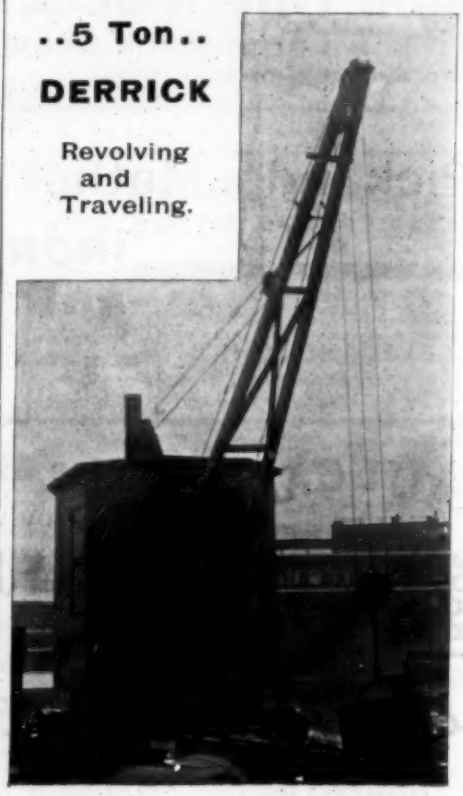

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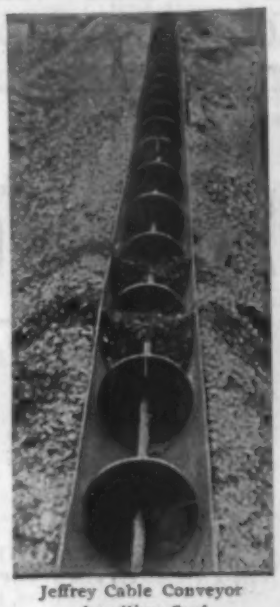

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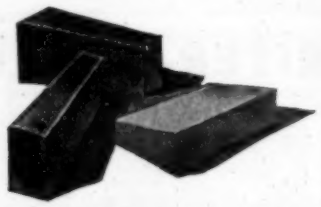

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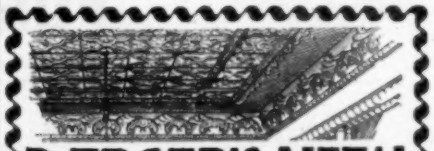

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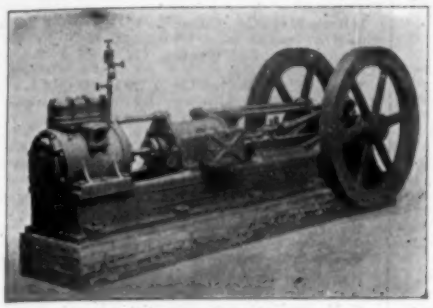

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Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland, Pa.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati, O.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.
Flexible Shafts—
Flue Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.
Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.
Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.
Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Milliett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.
Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Furnaces—
Playford Stoker Co., Cleveland, O.
Furnace Linings—
Union Mining Co., Mt. Savage, Md.
Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.
Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.
Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.
Gas Burners—
American Gas Furnace Co., New York City.
Gas Furnaces—
American Gas Furnace Co., New York City.
Gauge Cocks—
James Bonar & Co., Pittsburg, Pa.
Gearing.
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.
Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.
Gear Lubricants—
The Ironsides Company, Columbus, O.
Grease—
A. F. Boettcher, Rowlands, Pa.
Grindstones—
C. H. Besly & Co., Chicago, Ill.
Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,
Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.
Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
Brass Founders' Supply Co., Newark, N. J.
Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.
Hangers—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.
Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.
Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Valle Co., Dayton O.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Heating and Ventilating Apparatus -
B. F. Sturtevant Co., Boston.
Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O
Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co Cincinnati, O.
Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Machine Co., New York City.
Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.
Hotels—
United States Hotel Co., Cleveland, O.
Hydraulic Machinery—
Stilwell-Bierce & Smith-Valle Co., Dayton, O
Impulse Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Injectors—
C. H. Besly & Co., Chicago, Ill
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.
Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.
Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O
Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
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Skinner Chuck Co., New Britain, Conn.
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Danielson Machine & Tool Co., Cleveland, O.
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Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
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The S. Obermayer Co., Cincinnati, O.
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U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning Maxwell & Moore, New York City.
Lubricators—
A. F. Boettcher, Rowlands, Pa.
Machinery name Plates—
August Becker, Boston, Mass.
Machinists' Tools and Supplies—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co. Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
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Baush & Harris Machine Tool Co., Springfield, Mass.
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Machine Screws—
C. H. Besly & Co., Chicago, Ill.
Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
H. A. Streeter, Chicago, Ill.
Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Magnesia Covering—
C. H. Besly & Co., Chicago, Ill
Malleable Castings—
Acme Malleable Iron Works, Buffalo, N. Y.
Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.
Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O,
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelshia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Milling Machines—
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, NewYrok City.
Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.
Mine Pumps—
F. M. Prescott Steam Pump Co ,Milwaukee, Wis.
Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.
Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
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Molders' Tools—
The S. Obermayer Co., Cincinnati, O.
Name Plates—
August Becker, Boston, Mass.
Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.
Nuts and Bolts
Upson Nut Co., Cleveland, O.
Oiless Bearings—
C. H. Besly & Co., Chicago, Ill.
Oil Burners—
W. S. Rockwell & Co., New York City
American Gas Furnace Co., New York City.
Oil Cups—
C. H. Besly & Co., Chicago, Ill.
Oil Filters—
James Bonar & Co., Pittsburg, Pa.
Oil Pumps—
C. H. Besly & Co., Chicago, Ill.
Ore Crushers—
The Edward P. Allis Co., Milwaukee Wis
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York, City.
The Shearer-Peters Paint Co., Cincinnati, O.
Pattern Works—
Gobeille Pattern Co., Cleveland, O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Hickman & Williams, Chicago, Ill.
Spearman Iron Co. Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Pipe Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools.—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
Portable Forges—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis

Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Cranes—
R. Konigslow & Bro. Cleveland, O.

Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.

Rivets—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.

Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

Sand and Chill Molds—
Seaman, Sleeth Co., Pittsburg, Pa.

Saws—
Peter Gerlach & Co., Cleveland, O.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.

Shafting—
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

Shapers—
Baush & Harris Machine Tool Co., Springfield, Mass.
Fox Machine Co., Grand Rapids, Mich.

Shearing and Punching Machines—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Danielson Machine & Tool Co., Cleveland, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.

Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.

Special Machinery—
Edwin Harrington Son & Co., Philadelphia.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
R. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.

Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

Steam Separators—
James Bonar & Co., Pittsburg, Pa.

Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.

Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.

Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.

Steel Tubes—
Shelby Steel Tube Co., Cleveland, O.

Stokers—
Playford Stoker Co., Cleveland, O.

Tanks—
Enterprise Boiler Co., Youngstown, O
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.

Tank Cars—
The Wm. B. Pollock Co., Youngstown, O

Tin and Terne Plates—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.

Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

Tubes—
National Tube Works, McKeesport, Pa.
Shelby Steel Tube Co., Cleveland, O.

Tube Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Tube Welding—
S. Fix Sons, Cleveland, O.

Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.

Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
Manning, Maxwell & Moore, New York City.
James Bonar & Co, Pittsburg, Pa.

Ventilating Fans—
B. F. Sturtevant Co., Boston Mass.

Vises—
Massey Vise Co., Chicago, Ill.

Water Softening Plants—
We Pu Go Co., Cincinnati, O.

Wire Coating.
The Ironsides Company, Columbus, O.

Wire Filler.
The Ironsides Company, Columbus, O.

Wire Machinery—
The F. B. Shuster Co., New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.

Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.

Wire Rope Coating.
The Ironsides Company, Columbus, O.

Wire Rope Filling.
The Ironsides Company, Columbus, O.

Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.

Wrought Pipe—
National Tube Works, McKeesport, Pa.

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Cleveland City Forge & Iron Co	1
†Cleveland Facing Mill Co	33
Cleveland Rolling Mill Co	29
Cleveland Tool & Supply Co	28
Clinton Iron & Steel Co	29
*C. M. & St. P. Ry	—
Cole, J. Wendell	44
Covert Mfg. Co	30
Cramp & Sons, Wm	40
Cremer & Bicknell	31
Crescent Steel Co	37
Crowell Benedict	1
Danielson Machine & Tool Co	44
Delano, R. A	39
Dickman & MacKenzie	3
Dixon, Jos. Crucible Co	40
*Dodge Mfg. Co	35
Dover Fire Brick Co	32
Drake, Bartow & Co	39
Emmerton, F. A	2
Enterprise Boiler Co	1
Erikson, Edward E	1
Excelsior Iron Works Co	39
Fitzsimons & Co	39
*Fix Sons	37
Fleharty, J. H. & Co	—
Forster, Waterbury & Co	2
Fox Machine Co	1
Fraser & Chalmers	38
Frick Coke Co., H. C	31
Gandy Belting Co	1
Garden City Sand Co	44
Gerlach, Peter & Co	33
Gobeille Pattern Co	33
Goodyear, S. W	37
Greenwald Co., I. & E	26
Hall Steam Pump Co	37
Hanna & Co., M. A	33
Harrington & King Perforating Co	39
Harrison Safety Boiler Works	1
Hartford Steam Boiler Insp. & Ins. Co	31
Heyl & Patterson	33
†Hickman & Williams	30
Holmes, Strachan & Co	39
Hooven, Owens & Rentschler Co	32
Hunt Robt. W., & Co	27
Illinois Central R. R	34
Ingersoll-Sergeant Drill Co	1
Iron Clad Paint Co	40
Ironsides Co	22
Jeffrey Mfg. Co	31
Jenkins Bros	40
Jones & Co., John T	2
Jones Foundry & Machine Co., W. A	1
Jones & Laughlins, Ltd	41
Kentucky Fire Brick Works	23
Konigslow & Bro., R	26
La Belle Steel Co	37
Lake Superior Consolidated Iron Mines	39
Lane & Bodley	39
Laughlin & Co., Alex	31
Lidgerwood Mfg Co	30
Link-Belt Machinery Co	30
Lorain Steel Co	41
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Lusch, H. B	2
Main Belting Co	26
Manning, Maxwell & Moore	34
Marion Steam Shovel Co	44
McKeefrey & Co	39
Meehan Boiler & Construction Co	44
Merchant & Co	38
Millers Falls Co	44
Millett Core Oven Co	32
†Modern Machinery	—
Morris & Bailey Steel Co	37
*National Engraving Co	38
National Tube Works Co	43
†Newport Sand Bank Co	33
Northampton Emery Wheel Co	38
Nuttall Co. The R. D	27
Oak Hill Fire Brick & Coal Co	23
Obermayer, S. & Co	34
Oglebay, Norton & Co	29
†Ohio Sand Co	33
Ohio Steel Co	28
Otis Steel Co	27
†Parkhurst & Wilkinson Co	33
Perfect Lubricating Metal Co	44
Phillips' Sons Co., F. R	42
Phœnix Horse Shoe Co	23
Pickands, Mather & Co	1 9
Playford Stoker Co	40
Pneumatic Dome Mfg. Co	37
Pollock, The Wm. B. Co	1
Prescott Steam Pump Co	33
Q & C Co	21
Rand Drill Co	2
Reading Crane & Hoist Works	30
Riter-Conley Mfg. Co	31
Riverside Foundry Co	22
Robins Conveying Belt Co	31
*Rockwell & Co., W. S	1-26
Ryan, J. J. & Co	37
Sanderson Bros. Steel Co	37
Seaman, Sleeth Co	43
Sennett Co., Geo. B	39
Scioto Star Fire Brick Works	32
‖Sharon Fire Brick Works	—
Shearer-Peters Paint Co	24
Shelby Steel Tube Co	2
Shiffler Bridge Co	31
Shuster, The F. B., Co	26
Skinner Chuck Co	26
Southwark Foundry and Machine Co	36
Spearman Iron Co	44
Sprocket Chain Mfg. Co	22
Standard Paint Co	23
Stevens, F B	44-26
Stilwell-Bierce & Smith-Vaile Co	2
Streeter, H. A	2
Stroud & Co., E. H	2
Sturtevant Co., B. F	1-25
*Superior Charcoal Iron Co	26
Swarts Metal Refining Co	1
Tabor Mfg Co	32
Textor, O	2
Tod, Wm. & Co	39
Totten & Hogg Iron and Steel Foundry Co	42
Union Mining Co	22
Union Boiler Tube Cleaner Co	1
United States Hotel Co	39
Upson Nut Co	1
Van Dorn & Dutton Co	27
Vulcan Mfg. Co	30
Washington Coal and Coke Co	33
Webster, Camp & Lane Machine Co	23
Webster Fire Brick Co	1
We Fu Go Co	31
Wheeling Mold & Foundry Co	44
White, Byron H	37
Wyman & Gordon	43

BRÆBURN STEEL COMPANY, Bræburn, Pa.
MANUFACTURERS OF
FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, P. B. Hasbrouck, R. P. Kelly, Sec'y. and Treas.

MORE WEAR from your tools
.....Almost no **STEEL EXPENSE**
NO TROUBLE
"It pays to use the most reliable tool steel in the market."
SANDERSON BROS. STEEL CO.
Cleveland Warehouse, 97 Water St.

CRESCENT STEEL
ESTABLISHED 1866 ✦ INCORPORATED 1889.
CRESCENT STEEL CO.
480 PEARL ST. NEW YORK
PITTSBURGH, PA.
64 & 66 S. CLINTON ST. CHICAGO.

La BELLE STEEL CO., Pittsburgh, Pa.
MANUFACTURERS OF FINE
CRUCIBLE CAST TOOL STEEL.
SPECIAL GRADES FOR ALL PURPOSES.
BYRON H. WHITE,
Western Selling Agent.
OFFICE AND WAREHOUSE: **68 and 70 South Canal St., Chicago.**

BYRON H. WHITE, Western Selling Agent,
68-70 South Canal St., Chicago.

THE MORRIS & BAILEY STEEL CO.
COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING BLANKING DRAWING SPRINGS ETC
PITTSBURG, PA.
BYRON H WHITE
WESTERN SELLING AGENT
WAREHOUSE & OFFICE 68-70 SO. CANAL ST. CHICAGO

BYRON H. WHITE, Western Selling Agent, CHICAGO.

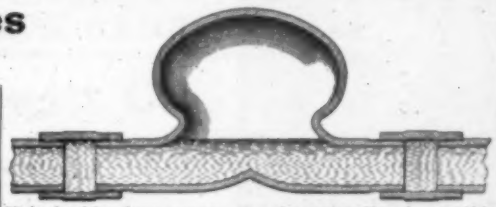
Don't Waste Money in Your Pattern Shop.
THE GOBEILLE PATTERN CO., Cleveland.

Burst Water Pipes
A Thing of the Past.

You can now make all water pipes as secure from bursting in winter as in summer. This pneumatic system is the only one which successfully prevents the annoying and costly bursting of water pipes. It has solved a great economic problem. Highly indorsed by architects, engineers and municipal officials.

No new house should be completed without this system, and all house owners should avail themselves of this "ounce of prevention" in season.

Send for illustrated booklet, giving full explanation.



This double slope causes the expanding ice to slide into the air dome, taking the strain off the pipe. The air cushion also prevents "hammering." Covered by United States and Foreign Patents.

LIBERAL DISCOUNT TO THE TRADE.

THE PNEUMATIC DOME MFG. CO.,
506 E Street, N. W., Washington, D. C.

BRASS FOUNDERS FINISHERS J. J. RYAN & CO.
68-74 West Monroe St., Chicago.
Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS On Short Notice.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	$3.75
No. 1 Specular, Bessemer	$3.15@3.50
No. 1 Bessemer hematite	2.75@3.25
Hematites No. 1 non-Bessemer	1.90@2.10
No 1. Specular, non-Bessemer	2.00@2.40
Mesabi Bessemer	1.80@2.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$16 65
No. 1 Strong Foundry	$16 75@17 00
No. 2 Strong Foundry	16 15@16 65
Gray Forge, red short	15 25@15 50
Gray Forge, neutral	15 15
No. 1 American Scotch	16 75@17 00
No. 2 American Scotch	15 15@16 65
Lake Superior Charcoal	17 00@18 00
PITTSBURG:	
No. 1 Foundry	$16 25@16 75
No. 2 Foundry	15 75@16 00
Gray Forge	14 75@15 00
Warm Blast Charcoal	18 00@19 00
Cold Blast Charcoal	24 00@26 00
Bessemer	17 00@17 50
CHICAGO:	
Lake Superior Charcoal	$17 00@$18 00
Local Coke Foundry No. 1	15 50@15 75
Local Coke Foundry No. 2	15 00@15 50
Local Coke Foundry No. 3	14 50@14 75
Local Scotch Foundry No. 1	15 50@15 75
Local Scotch Foundry No. 2	15 00@15 50
Local Scotch Foundry No. 3	14 50@14 75
Southern Coke No. 1	16 00@16 25
Southern Coke No. 2	15 25@15 75
Southern Coke No. 3	14 75@15 00
Southern No. 1 Soft	15 50@16 00
Southern No. 2 Soft	15 00@15 50
Southern Silveries	15 50@16 00
Jackson Co. Silveries	17 00@18 00
Ohio Silveries No. 1	.....
Ohio Strong Softeners	15 50@16 50
Alabama Car Wheel	17 50@18 00
Malleable Bessemer	15 50@16 00
Coke Bessemer	15 50@16 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$14 75@15 25
Southern Coke No. 2 and No. 1 Soft	14 25@14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@18 00
Tennessee Charcoal No 1	15 00@16 00
Jackson County Silvery No 1	16 00@16 25
Southern Coke, Gray Forge	12 75@13 00
" " Mottled	12 75@13 00
Standard Georgia Car Wheel	15 50@16 00
Lake Superior " "	15 50@16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 60
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	14 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 55
Southern Gray Forge	13 80
Tennessee Charcoal No 1	13 75
Jackson County 8 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@16 00
Southern Car Wheel	15 25@16 25
Genuine Connellsville Coke	4 15
West Virginia Coke	4 10

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 50
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.60c
Angles	1.65c
Tees	65c
Universal Plates	200@2.25c
Sheared Plates	2.25c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]
Rounds and Squares.—Bar Iron.

1 to 1½	1.80 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4½	1.00 "
4½ to 5	1.30 "
5¼ to 6	1.60 "
5¼ to 6½	2.00 "

BABBITT METALS

All standard and special grades.
In sectional molds or bars.

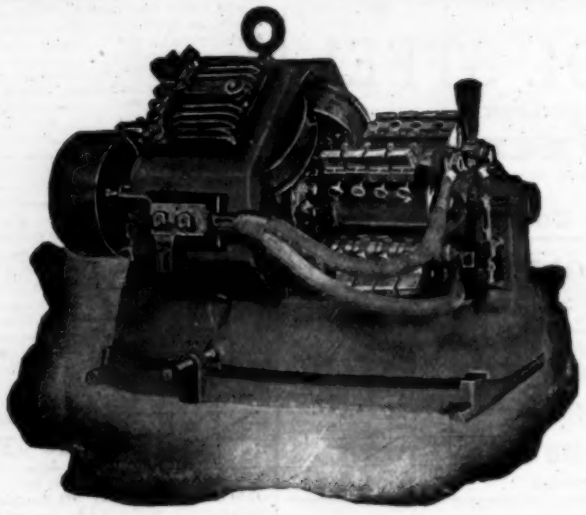
Phila. Chicago. **MERCHANT & CO., Inc.** New York. Brooklyn

Wrtte us for prices always. It will pay you.

Eddy Dynamo Electro-Plating Machines

— FOR —

BICYCLE PLATING PLANTS.



NORTHAMPTON EMERY WHEEL CO., 20 S. Canal St., Chicago, Ill.

EXCLUSIVE WESTERN SELLING AGENTS.

The
National Engraving Co.

204 Superior St.
CLEVELAND,
OHIO.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

6⅝ to 7¾	2.50 extra
¾ to ⅞	.10 "
⅝ to 11-16	.20 "
⅞ to 9-16	.30 "
7-16 to 15-32	.30 "
½ to 13 2	.40 "
5-16 to 1 -32	.50 "
¼ to 9-32	.70 "
7-32	.90 "
3-16	1.40 "
	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.20 "
8¼ o 10 x ⅜ to 1	.60 "
1⅜ o 4 x 1 1-16 to 1½	.80 "
4¼ to 6 x 1 1-16 to 1½	.30 "
6¼ to 8 x 1 1-16 to 1½	.40 "
8¼ to 10 x 1 1-16 to 1½	.60 "
2 to 4 x 1⅝ to 2	.90 "
4¼ to 6 x 1⅝ to 2	.50 "
6¼ to 8 x 1⅝ to 2	.60 "
8¼ to 10 x 1⅝ to 2	.80 "
2to 4 x 2⅛ to 3	1.00 "
4¼ to 6 x 2⅛ to 3	.60 "
6¼ to 8 x 2⅛ to 3	.80 "
1⅝ to 1¾ x ⅜ to 1	1.00 "
1 to 1 1-16 x ⅜ to ⅝	.10 "
¾ to 15-16 x ⅜ to ¾	.20 "
⅝ to 11-16 x ⅜ to ⅝	.40 "
⅞ to 9-16 x ⅜ to ⅝	.50 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1¾ x ¼ to 5-16	.30
¼ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¾ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅝ to 1⅜	.40 extra
¾ to 13-16	.50 "
⅞ to 11-16	.60 "
1 to 9-16	.80 "
1⅛ to 7-16	1.10 "
1¼ to 9-16 x 3-16	1.20 "
1⅜ to 11-16 x ¼	1.30 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅞ to 11-16	.90 "
1 to 9-16	1.30 "
1⅛ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes .1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

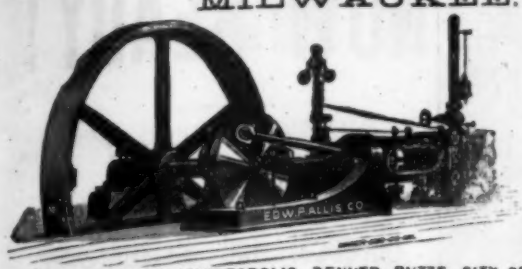
Width In Inches.	English Standard Gauge.		Extras.
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16 "	1.50	Base.
1¼ to 6,	" 10, 11, 12 or ¼"	.05	per 100 lbs.
1 to 1¾,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¾,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-19	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜.	" 10, 11, 12 or ¼"	1.05	"

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		Extras.
7-16 to 3	Nos. 13, 14, 15 and 16	1.60	Base
7-16 to 2,	" 17, 18, and 19	.05	per 100 lbs
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
¼ to 1¾,	" 13, 14 and 15	.05	"
¼ to 1¾,	" 16, 17 and 18	.10	"

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills. Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

NEW YORK CHICAGO, MINNEAPOLIS, DENVER, BUTTE CITY OF MEXICO SAN FRANCISCO, PITTSBURG

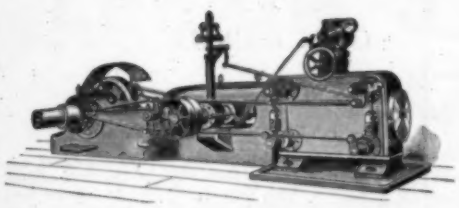
Southwark Foundry & Machine Co.

PHILADELPHIA, PA.

Porter-Allen Automatic Engines,
Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine

Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.

SEWARD S. BABBITT.

The Geo. B. Sennett Co., Youngstown, Ohio,

MANUFACTURERS OF

Sennett Compression Coupling

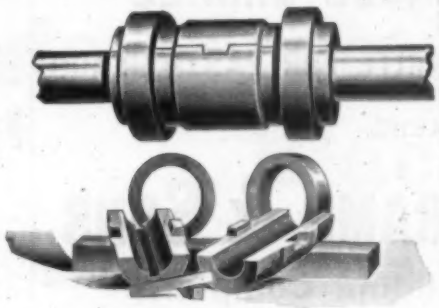
And Other Specialties.

We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.
We make also the

SENNETT ENGINE

20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

1¼ to 1¾,	"	19 and 20	1.25	1.60
1¼ to 1¾,	"	21	.30	"
1¼ to 1¾,	"	22	.30	"
15-16 and 1,	"	13, 14 and 15		"
15-16 and 1,	"	16, 17 and 18	.15	"
15-16 and 1,	"	19 and 20	.20	"
15-16 and 1,	"	21	.25	"
15-16 and 1,	"	22	.35	"
⅞,	Nos. 13, 14 and 15		.30	"
⅞,	" 16, 17 and 18		.25	"
⅞,	" 19 and 20		.30	"
⅞,	" 21		.35	"
⅞,	" 22		.45	"
⅞ and 13-16	Nos. 13, 14 and 15		.30	"
⅞ and 13-16	" 16, 17 and 18		.35	"
⅞ and 13-16	" 19 and 20		.40	"
⅞ and 13-16	" 21		.45	"
⅞ and 13-16	" 22		.50	"
⅞ and 13-16	" 23		.60	"
11-16,	Nos. 13, 14 and 15		.35	"
11-16,	" 16, 17 and 18		.40	"
11-16,	" 19 and 20		.50	"
11-16,	" 21		.60	"
11-16,	" 22		.70	"
11-16,	" 23		.80	"
⅝,	Nos. 13, 14 and 15		.40	"
⅝,	" 16, 17 and 18		.45	"
⅝,	" 19 and 20		.55	"
⅝,	" 21		.65	"
⅝,	" 22		.75	"
⅝,	" 23		.85	"
9 16,	" 13, 14 and 15		.45	
9-16,	" 16, 17 and 18		.50	
9-16,	" 19 and 20		.60	
9-16,	" 21		.70	
9-16,	" 22		.80	
9-16,	" 23		.90	
½,	" 13, 14 and 15		.55	
½,	" 16, 17 and 18		.60	
½,	" 19 and 20		.70	
½,	" 21		.80	
½,	" 22		.90	"
½,	" 23		1.00	"
7-16,	" 13, 14 and 15		.80	"
7-16,	" 16, 17 and 18		.90	"
7-16,	" 19 and 20		1.00	"
3/8,	" 13, 14 and 15		1.00	"
3/8,	" 16, 17 and 18		1.10	"
3/8,	" 19 and 20		1.20	"

Sheet Iron.

No. 10	2 25
No. 12	2 25
No. 14	2 30
No. 15-17	2 40
No. 18	2 50
No. 20	2 70
No. 22-24	2 70
No. 25-26	2 80
No. 27	2 90

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 40
Flange	2 60
Marine Flange	2 75
Fire Box	3c to 3½

Above includes plates 90 inches wide.

90 to 96 in. wide	1c. lb. extra
96 to 100 in. wide	1½c. "
100 to 104 in. wide	2c. "
104 to 106 in. wide	special.

Burden Boiler Rivets.

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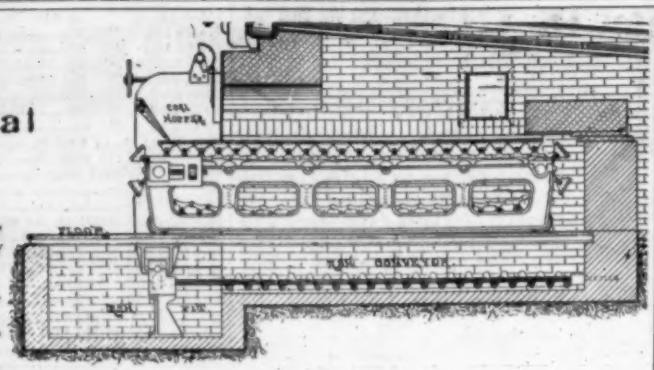

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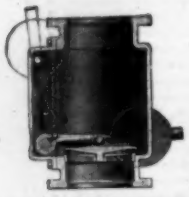

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

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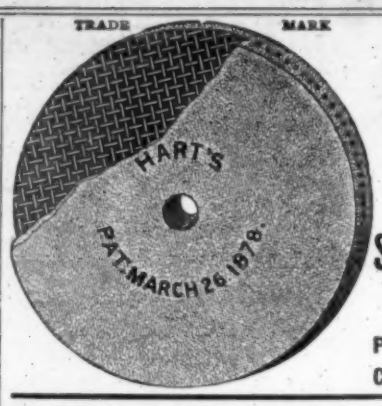

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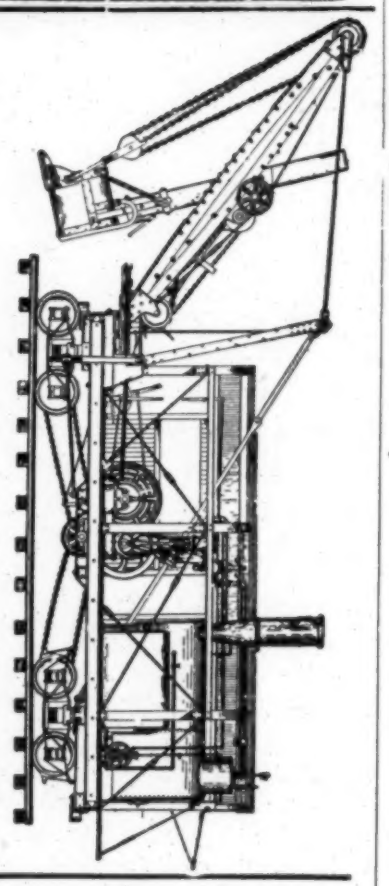

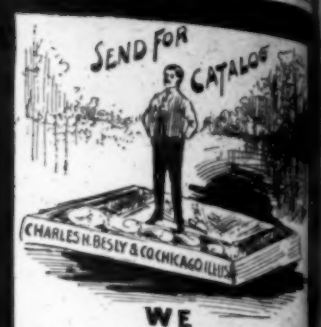

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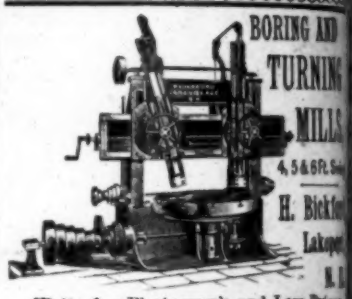

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